



**Office of Transport and Traffic Policy and Planning  
Ministry of Transport**

## **Program Management Services : PMS**



### **Central Clearing House Contractor Performance Evaluation Report No.1**



**Avantgarde Capital Co., Ltd.**



**Korea Smart Card Co., Ltd.**



**PSK Consultants Co., Ltd.**

**January 2016**





## Program Management Services

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By

Avantgarde Capital Co., Ltd.

Korea Smart Card Co.,Ltd.

PSK Consultants Co., Ltd.

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## Chapter 1 Introduction

## 1.1 Objectives

According to the section 4 of Program Management Services (PMS) contract scope of work; support the supervision of contractor work activities for implementation of CCH. It contains the following responsibilities;

(1) Support the supervision to ensure the contractor carry out the work according to specification and condition of contract such as smart card issuing, CCH establishment, and operation & maintenance as follows;

- Support the supervision of CCH system implementation and testing
- Support the supervision of interface work between the future transit system's Front-end which requires to launched the common ticketing system and the CCH's Back-end
- Support the verification activities to ensure that the CCH Contractor has implemented the system according to requirement.
- Support the supervision of interface work of the CCH and the transit Service Providers' Front-ends interface to ensure the work has been carried out according to Operation and Maintenance period.

(2) Support the supervision and management task according to contract as follows;

- Support the design verification according to Employer's requirements, outline design specification, and conceptual drawing
- Support the supervision of system development and installation work according to system development and Installation outline specification
- Support the supervision and monitoring of the CCH Contractor to ensure the works complete according to the contract
- Support the supervision, and approval of the completed work in order to support each milestone acceptance
- Support the supervision of work throughput in order to prepare the certificate, payment and review the CCH Contractor's invoice
- Support the supervision and provide recommendation related to any claims or contract provisions resulted by operations according to the contract (if any)

- Compile and verify the drawing that has to be provided and installed according to the Conditions of Contract
- Compile and make the file index and important notes which will be submitted to the Common Ticketing Office
- Follow up the contractor for preparation of Operation Manual and Training Manual and provide training for the Common Ticketing Office's staff
- Supervision the Test and Commissioning
- Support the supervision during the maintenance period at interval as necessary and appropriate during the time frame of PMS contract

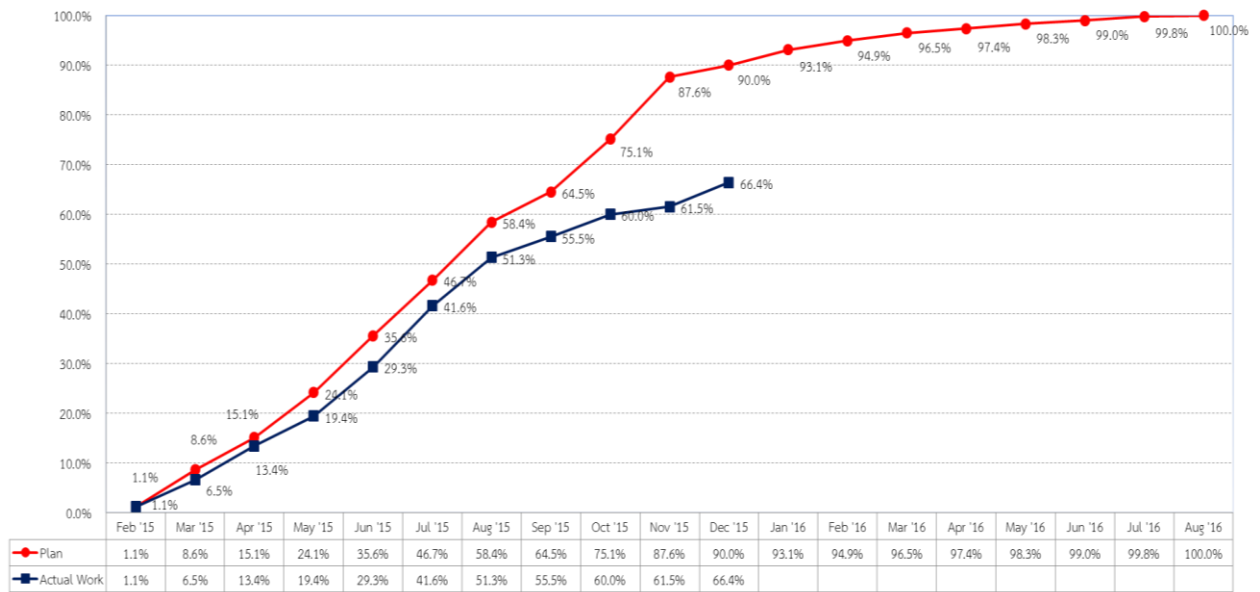
According to the Contract's conditions on report deliverable, the PMS consulting group has prepared a report to evaluate the CCH Contractor's performance. This report is the first CCH Contractor performance evaluation

## 1.2 Current Progress

The CCH implementation progress is divided into 5 sections consisting of System Design, System Development, Prototype, Test and Commissioning and Training. The operating duration is in total of 18 months, excluding 2-year maintenance and service providers' Front-end connection for the 19<sup>th</sup> – 30<sup>th</sup> month starting from August 16, 2018.

During February 16, 2015 – December 30, 2015 the CCH system development progress and the BSV Consortium performance can be summarized as follows; currently the CCH implementation project has completed the system design accounting for 100% progress of the system design. The system development progress accounts for 46% out of 77% of the system development. The progress of system for testing accounts for 25% out of 37% of the system for testing. The system testing progress is 22% out of 31% of the system testing. The training progress is 10% out of 28% of the training. In summary, the progress accumulated until December 30, 2015 accounts for 66.4% out of 90% of the plan, with delay of 23.6% because an equipment manufacturer cancelled its manufacturing for certain equipment proposed by the BSV Consortium.

Chart 1-1 Central Clearing House Development Plan for 18 Months



## Chapter 2 Consultant Review Process

## 2.1 Document Reviews

The PMS Consulting Group has reviewed the Establishment of the Central Clearing House Project's documents submitted by the BSV Consortium to the OTP as follows;

- (1) Project Management Plans
- (2) Design Documents
- (3) Development Documents
- (4) Testing Documents
- (5) Training Documents
- (6) User Documents

The number of documents the BSV Consortium is required to submit and the document review status can be summarized as in **Table 2-1**.

**Table 2-1 Current Status of the Central Clearing House Development Project's Documents**

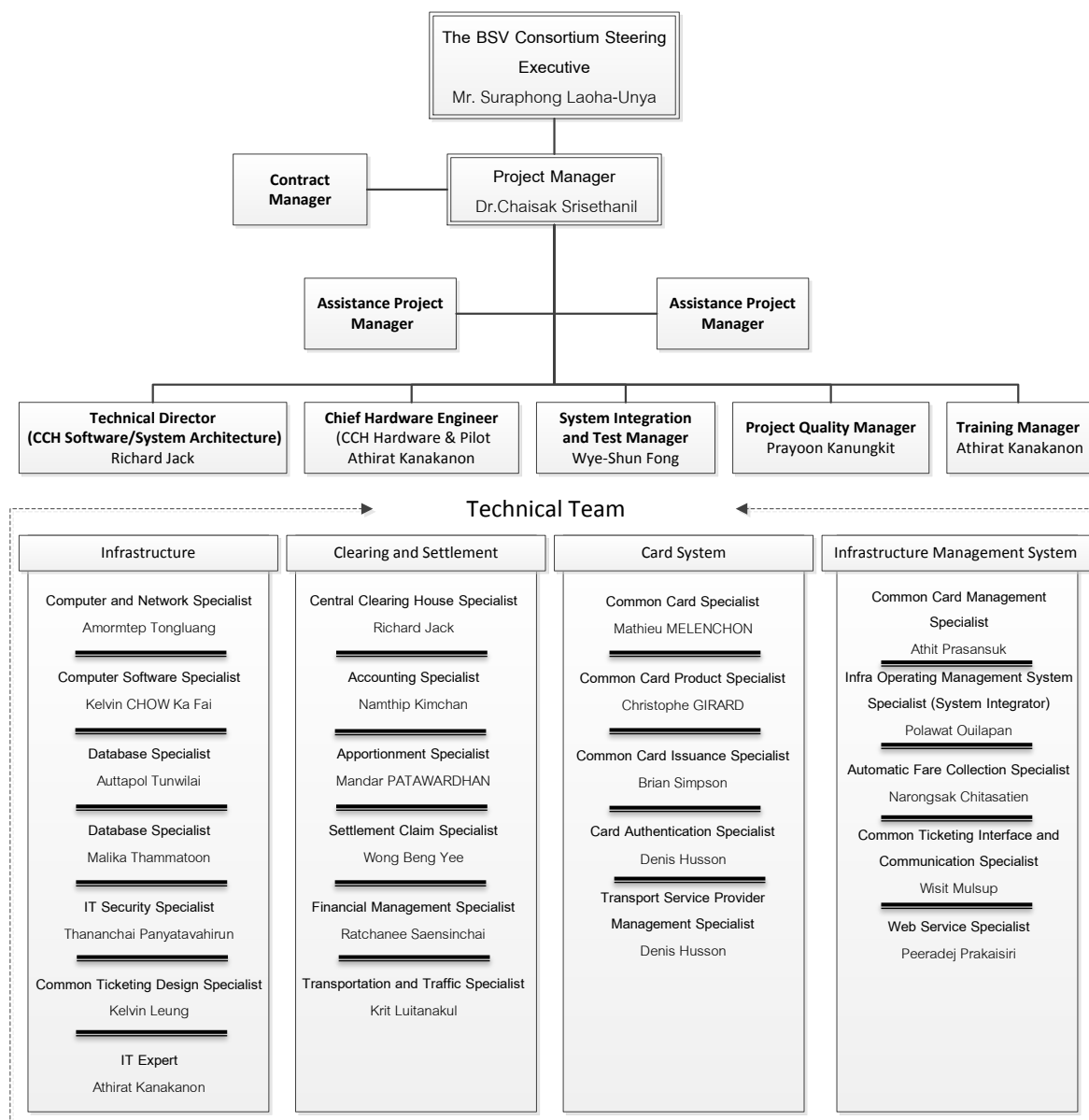
| No. | Details                  | The Total Number of Documents | The Number of Documents received by PMS | The Number of Documents under PMS Reviews | The Number of Documents reviewed by PMS Completely |
|-----|--------------------------|-------------------------------|-----------------------------------------|-------------------------------------------|----------------------------------------------------|
| 1   | Project Management Plans | 6                             | 6                                       | 0                                         | 6                                                  |
| 2   | Design Documents         |                               |                                         |                                           |                                                    |
|     | - System Architecture    | 7                             | 7                                       | 0                                         | 7                                                  |
|     | - Design Specifications  | 20                            | 20                                      | 0                                         | 20                                                 |
|     | - Interface              | 6                             | 6                                       | 0                                         | 6                                                  |
|     | - Detail Designs         | 24                            | 24                                      | 0                                         | 24                                                 |
| 3   | Development Documents    | 7                             | 4                                       | 0                                         | 4                                                  |
| 4   | Testing Documents        | 25                            | 10                                      | 0                                         | 10                                                 |
| 5   | Training Documents       | 40                            | 0                                       | 0                                         | 0                                                  |
| 6   | User Documents           | 27                            | 1                                       | 0                                         | 1                                                  |
|     | Total                    | 162                           | 71                                      | 1                                         | 70                                                 |

### 2.1.1 Project Management

The BSV Consortium has submitted the project management-related documents consisting of organization management plan, quality management, main operational plan, document delivery schedule and project coordination plan, with details as follows;

1. Organization Management Plan shows organization management for the Establishment of the Central Clearing House, staff responsibilities, and staff qualifications consisting of project operation's main staff and technical staff, as shown in **Chart 2-1**.

Chart 2-1 BSV Consortium's Organization Plan



2. Draft of Quality Management Plan is drafted to assure that the performance, both system functions and efficiency, are accurate and appropriate according to the customer demands and predetermined period. The BSV Consortium's quality management plan draft involves activities, stages and various processes of the Central Clearing House development project.

3. Quality Management contains details about the quality management plan to ensure that the system functions and efficiency are accurate and appropriate according to the customer demands and predetermined period. The project's operating and supporting staff have to perform according to the details in the quality management document. During the operation, a quality management's responsible person probably improves or modifies the quality management document details to be suitable for the operation. The content consists of activities, steps and process of quality management certification for the Establishment of the Central Clearing House project. It also includes quality management methods, acceptable standard quality, and certification of quality, activities and their quality control.

4. Main Operational Plan is the project's main operational plan which explains activities' periods throughout the project agreement term, including holding meeting for coordination, meeting with the OTP and the PMS Consulting Group, and meetings with the third party. The meetings are to determine the Establishment of the Central Clearing House project's staff responsibility list for effective communication, and set a standard for document preparation and effective management of main documents.

5. Document Delivery Schedule

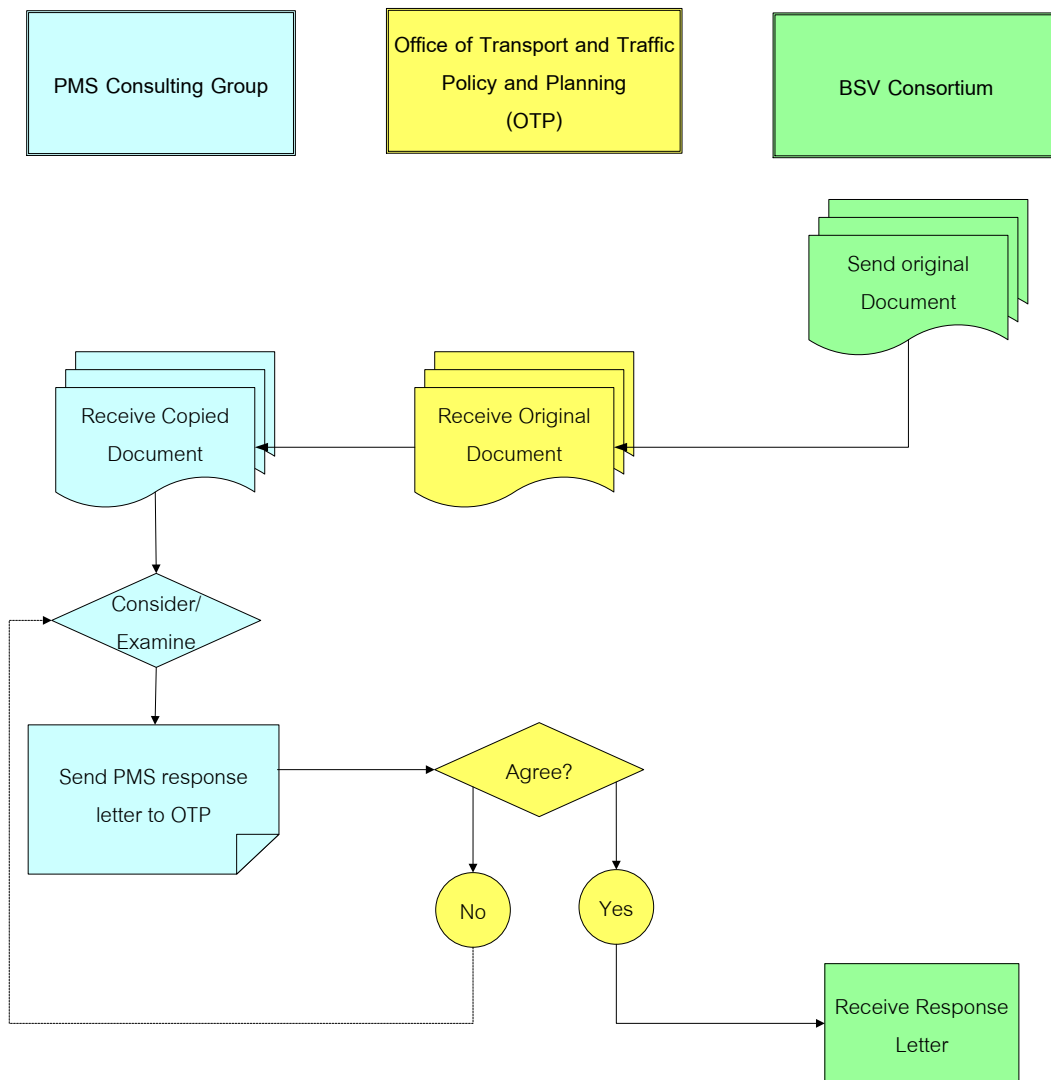
Document delivery schedule identifies a list of documents to be submitted to the OTP. It consists of project management documents, design documents, system development documents, testing documents, user documents and training documents. The document list can be modified as the OTP sees fit. At the present, the actual document delivery plan is perform as shown in **Table 2-2**.

Table 2-2 BSV Consortium's Document Delivery Plan

| Document List            | Delivery Schedule           | Actual Operating Period                                                                                                                                                        |
|--------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project Management Plans | March 2015 – May 2015       | March 2015 – August 2015                                                                                                                                                       |
| Design Documents         | March 2015 – August 2015    | March 2015 – September 2015                                                                                                                                                    |
| Development Documents    | August 2015 – November 2015 | Under the process<br>(Commencing in August 2015)                                                                                                                               |
| Testing Documents        | March 2015 – January 2016   | Under the process (start sending the testing plan in March 2015, now under the submitting process to the OTP)                                                                  |
| Training Documents       | April 2016 – October 2016   | Under the process<br>( Currently the BSV Consortium has delivered the training and technology transfer plan in August 2015, but the training manual hasn't yet been delivered) |
| User Documents           | October 2016                | The BSV Consortium is preparing the documents.                                                                                                                                 |

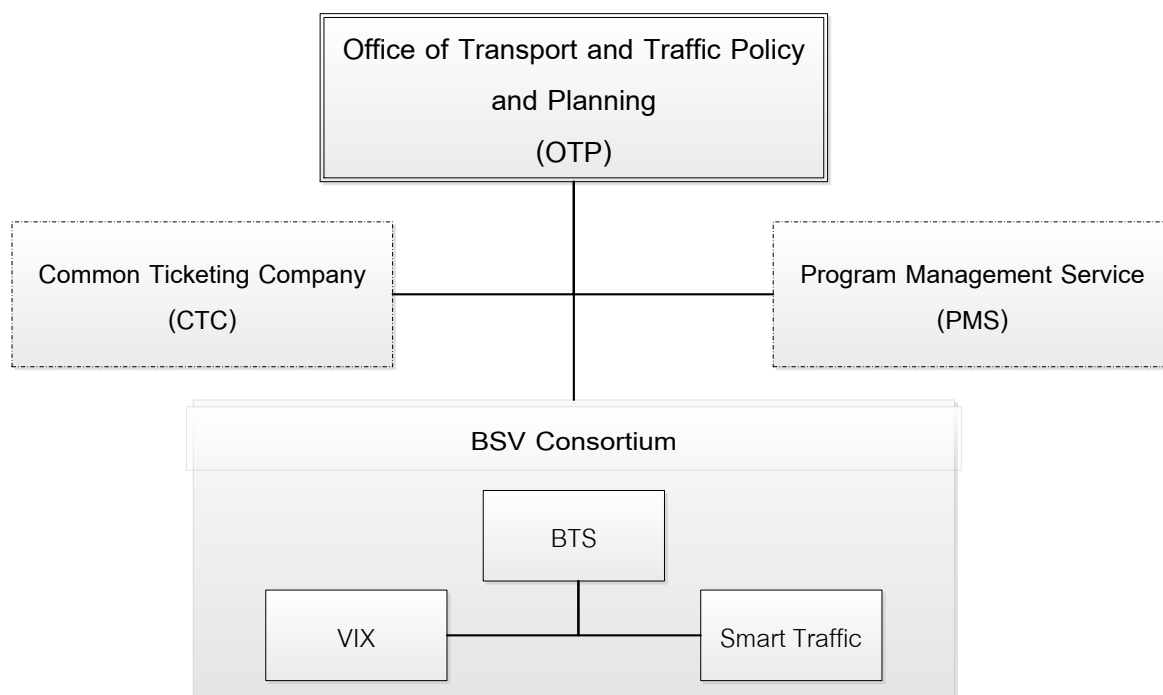
According to the BSV Consortium's document delivery and the OTP and PMS's consideration, the document delivery and consideration are performed according to the **Chart 2-2**.

Chart 2-2 BSV Consortium Documentation Process



6. Project Coordination Plan shows coordination plan in order to request for information from the related third party and to connect the system to the service providers' Front-ends throughout the project's term, to ensure that the performance is in accordance with the plan. The BSV Consortium is required to coordinate with internal departments to inform them before coordinating with the related third party, as shown in **Chart 2-3**.

Chart 2-3 Coordination Plan between Related Internal Departments



In the operation, the BSV Consortium has provided coordination plan with the related third party with details as shown in **Table 2-3**.

Table 2-3 Coordination Plan for BSV Consortium and Related Departments' Operations

| No. | Details                                      | Coordination                                                | Agencies       | Schedule              |
|-----|----------------------------------------------|-------------------------------------------------------------|----------------|-----------------------|
| 1   | System Design                                |                                                             |                |                       |
| 1.1 | Business Rules                               | Finalize the Business Rules Requirement and design approval | OTP/PMS/CTC/SP | 3 <sup>rd</sup> Month |
| 1.2 | Card Data Definition                         | Finalize the Requirement and design approval                | OTP/PMS/CTC/SP | 3 <sup>rd</sup> Month |
| 1.3 | Parameter Data Definition                    | Finalize the Requirement and design approval                | OTP/PMS/CTC/SP | 3 <sup>rd</sup> Month |
| 1.4 | Transaction Data Definition                  | Finalize the Requirement and design approval                | OTP/PMS/CTC/SP | 3 <sup>rd</sup> Month |
| 1.5 | System Security Design                       | Finalize the Requirement and design approval                | OTP/PMS/CTC    | 3 <sup>rd</sup> Month |
| 1.6 | CCH System and Subsystem Function and Design | Approval on design specification                            | OTP/PMS/CTC    | 4 <sup>th</sup> Month |
| 1.7 | KMF Design and Function                      | Approval on design specification                            | OTP/PMS/CTC    | 4 <sup>th</sup> Month |
| 1.8 | CIPS Design and Function                     | Approval on design specification                            | OTP/PMS/CTC    | 4 <sup>th</sup> Month |

| No.  | Details                                           | Coordination                                                                      | Agencies       | Schedule               |
|------|---------------------------------------------------|-----------------------------------------------------------------------------------|----------------|------------------------|
| 1.9  | Refund and Reload Design and Function             | Approval on design specification                                                  | OTP/PMS/CTC    | 4 <sup>th</sup> Month  |
| 1.10 | Central Clearing House (CCH) Report Specification | Review and approve the design report                                              | OTP/PMS/CTC    | 6 <sup>th</sup> Month  |
| 1.11 | Prototype - Rail                                  | Approval on list of functions to be test                                          | OTP/PMS/CTC    | 4 <sup>th</sup> Month  |
| 1.12 | Prototype - Toll                                  | Approval on list of functions to be test                                          | OTP/PMS/CTC    | 4 <sup>th</sup> Month  |
| 1.13 | Prototype - NFC                                   | Approval on list of functions to be test                                          | OTP/PMS/CTC    | 4 <sup>th</sup> Month  |
| 1.14 | Prototype - Retail                                | Approval on list of functions to be test                                          | OTP/PMS/CTC    | 4 <sup>th</sup> Month  |
| 2    | System Implementation                             |                                                                                   |                |                        |
| 2.1  | Hardware Bill of Materials                        | Approval of Hardware Bill of Materials                                            | OTP/PMS/CTC    | 6 <sup>th</sup> Month  |
| 2.2  | Software Bill of Materials                        | Approval of Software Bill of Materials                                            | OTP/PMS/CTC    | 6 <sup>th</sup> Month  |
| 2.3  | Data Center                                       | Acknowledge for location, security and facilities of Data Center and its facility | OTP/PMS/CTC    | 8 <sup>th</sup> Month  |
| 2.4  | Server and accessory layout and rack diagram      | Approval of layout and rack diagram                                               | OTP/PMS/CTC    | 8 <sup>th</sup> Month  |
| 3    | Test and Commissioning                            |                                                                                   |                |                        |
| 3.1  | Test Plan                                         | Approval of Test Plan                                                             | OTP/PMS/CTC    | 9 <sup>th</sup> Month  |
| 3.2  | Functionality Acceptance Test                     | Participate in the Acceptance Test                                                | OTP/PMS/CTC    | 11 <sup>th</sup> Month |
| 3.3  | System Integration Test with Prototypes           | Participate in the Acceptance Test                                                | OTP/PMS/CTC    | 12 <sup>th</sup> Month |
| 4    | Coordination with Front-End Upgrade               |                                                                                   |                |                        |
| 4.1  | Coordination on Integration design work           | Participate in the Integration design                                             | OTP/PMS/CTC/SP | 10 <sup>th</sup> Month |
| 4.2  | Coordination on Integration test                  | Participate in the Integration test                                               | OTP/PMS/CTC/SP | 12 <sup>th</sup> Month |
| 5    | Technology Transfer                               |                                                                                   |                |                        |
| 5.1  | Training Material Preparation                     | Approval of training materials                                                    | OTP/PMS/CTC    | 7 <sup>th</sup> Month  |
| 5.2  | Training Classes                                  | Attend training session                                                           | OTP/CTC        | 9 <sup>th</sup> Month  |
| 6    | Operation and Maintenance                         |                                                                                   |                |                        |
| 6.1  | System Operation Manual                           | Review and approve Operation Manual                                               | OTP/PMS/CTC    | 6 <sup>th</sup> Month  |
| 6.2  | System Maintenance Manual                         | Review and approve Maintenance Manual                                             | OTP/PMS/CTC    | 6 <sup>th</sup> Month  |

## 2.1.2 Design Documents

### 2.1.2.1 PMS Consulting Group's design monitoring

BSV Consortium, the common ticketing and CCH system contractor, have submitted 57 documents for system design consisting of;

1. Architecture Documents present the architecture design concept and relations between subsystem combined into the system in order to show the system overview including of Central Clearing House System, Security System, Common Ticketing Structure and various parameters.
2. Requirements Documents gather users and service providers' system requirements to be used for the detail design. It includes the OTP's requirements and suggestions obtained from coordination meeting and workshop.
3. Interface Documents show the interfacing, data transfer, with Transit's and Non-transit's front-end, banking system, and communication between transit and non-transit service providers, and card's users.
4. Design Documents shows details of CCH's sub-system components and the interface between subsystems and other related systems.

During the design stage, the PMS Consulting Group and BSV Consortium arrange the workshop to gather the opinion from related parties. The participants' suggestions and opinion were considered.

The BSV Consortium submitted all design documents to be completed in September 2015. The PMS Consulting Group reviewed the documents and gave the BSV Consortium feedback to correct the documents to be in accordance with the specification and the Establishment of the Central Clearing House's scope of works, General Specification, appendix 6, Business Rules and the Particular Specification. The suggestions and document consideration results are provided in Appendix A.

Currently, this task is completed and the BSV Consortium has already submitted the CCH design results to the CCH's CCH Acceptance Committee with the following details;

CCH Acceptance Committee Meeting No. 2/2015 on November 5, 2015. The meeting was arranged to explain the system details design. The Meeting's resolution is assigned the Committee to reconsider the Disbursement Form for the 1<sup>st</sup> Milestone – Design Approval and gave feedback and observation to the BSV Consortium for explanation or correction of the document.

CCH Acceptance Committee Meeting No. 3/2015 on November 25, 2015. The meeting was held to summarize the committee's suggestions and observation. The meeting resolution regarding the number of card issuers was that the number, from a maximum of 10 issuers, should be increased

to exceed 10 issuers. The BSV Consortium is assigned to search for the methods and prepare for documents providing additional information and reasons for such decision.

CCH Acceptance Committee Meeting No. 4/2015 on November 30, 2015. The BSV Consortium presented the principles for card issuer quantity increment without affecting the project's schedule which is already approved by the OTP. Moreover, the Meeting's resolution approved the design approval milestone.

Details of system design and design verification are shown in Chapter 3 in this report.

### 2.1.3 System Development Documents

The Central Clearing House development documents includes the installation and commissioning plan. The development documents consist of;

1. The Central Clearing House (CCH) Development Report
2. Procurement Plan
3. Hardware Bill of Materials
4. Software Bill of Materials
5. Third Party Software Bill of Materials
6. Installation and Commissioning Plan
7. Deployment Plan

Regarding this section's progress at the end of December 2015, the BSV Consortium submitted the CCH's Software and Hardware Bill of Materials to the OTP and the PMS Consulting Group for consideration before the procurement. The PMS Consulting Group's opinion on the Software and Hardware Bill of Materials was summarized in **Appendix A**.

The BSV Consortium submit a letter to inform that some equipment was discontinued and propose the following equipment to replace the discontinued one;

Table 2-4 List of Proposed Equipment to Replace the Project's Existing Equipment

| No. | List               | Equipment Stipulated in the Contract Proposals | Proposed Equipment for Replacement |
|-----|--------------------|------------------------------------------------|------------------------------------|
| 1   | Database Server    | Sun Fire X4-2 Server                           | Sun Fire X5-2L Server              |
| 2   | Application Server | Sun Fire X4-2 Server                           | Sun Fire X5-2L Server              |
| 3   | Back up Management | Sun Fire X4-2 Server                           | Sun Fire X5-2L Server              |
| 4   | External Storage   | Pillar Axiom                                   | Oracle FS1-2 Flash Storage         |

The PMS Consulting Group has compared the equipment's properties and efficiency and submitted the information to the OTP and the committee for consideration as follows;

Table 2-5 Comparison of Replacing Equipment Properties

| No. | List               | Equipment proposed for the project                                                                                                              | Equipment requested for modification approval                                                                                                       | PMS Consulting Group's Opinion                                                                                                                                                                                                                                                                                                          |
|-----|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Database Server    | Sun Fire X4-2 Server<br>- CPU : 2 x E5-2690v2 Intel 10 Core 3.0 GHz<br>- Memory : 128 GB<br>- I/O : 2 x Dual 8Gbps FC HBA<br>: 1 x Quad GbE HBA | Sun Fire X5-2L Server<br>- CPU : 2 x E5-2690v3 Intel 12 Core 2.6 GHz<br>- Memory : 128 GB<br>- I/O : 2 x Dual 16Gbps FC HBA<br>: 2 x Dual 10GbE HBA | The proposed equipment is the newer version, with Fiber Channel speed of 16 Gbps, from the previous version 8Gbps, so the data transfer between SAN and the machine can perform better. It also has 10Gbps Ethernet Port improved from the previous 1Gbps one, so the data transfer between the network and machine can perform better. |
| 2   | VmwarevSphereGroup | Sun Fire X4-2 Server<br>- CPU : 2 x E5-2690v2 Intel 10 Core 3.0 GHz<br>- Memory : 64 GB<br>- I/O : 2 x Dual 8Gbps FC HBA<br>: 1 x Quad GbE HBA  | Sun Fire X5-2L Server<br>- CPU : 2 x E5-2690v3 Intel 12 Core 2.6 GHz<br>- Memory : 64 GB<br>- I/O : 2 x Dual 16Gbps FC HBA<br>: 2 x Dual 10GbE HBA  | The proposed equipment is the newer version, with Fiber Channel speed of 16 Gbps, from the previous version 8Gbps, so the data transfer between SAN and the machine can perform better. It also has 10Gbps Ethernet Port improved from the previous 1Gbps one, so the data transfer between the network and machine can perform better. |

| No. | List                 | Equipment proposed for the project                                                                                                          | Equipment requested for modification approval                                                                                                   | PMS Consulting Group's Opinion                                                                                                                                                                                                                                                                                                                                      |
|-----|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3   | Host NetBackup Group | Sun Fire X4-2 Server<br>- CPU : 2 x E5-2690v2 Intel 10 Core 3.0 GHz<br>- Memory : 64 GB<br>- I/O : 2 x Dual 8Gbps FC HBA : 1 x Quad GbE HBA | Sun Fire X5-2L Server<br>- CPU : 2 x E5-2690v3 Intel 12 Core 2.6 GHz<br>- Memory : 64 GB<br>- I/O : 2 x Dual 16Gbps FC HBA : 2 x Dual 10GbE HBA | The proposed equipment is the newer version, with Fiber Channel speed of 16 Gbps, from the previous version 8Gbps, so the data transfer between SAN and the machine can perform better. It also has 10Gbps Ethernet Port improved from the previous 1Gbps one, so the data transfer between the network and machine can perform better.                             |
| 4   | External Storage     | Pillar Axiom 600<br>- Cache : 48GB<br>- Disk : 48 x 900 GB FC 15K : 13 x 2TB SATA 7.2K                                                      | Oracle FS1-2 Flash Storage<br>- Cache : 384GB<br>- Disk : 7 x 400GB SSD : 48 x 900GB SAS 10K : 24 x 4TB SAS 7.2K                                | 1. The proposed equipment has 384GB Cache Memory which is higher than the previous 48GB one.<br>2. The proposed equipment uses Solid State Disk, a new technology that makes reading-writing data faster than the previous Hard Disk type. The equipment's Hard Disk capacity is also increased to 4TB in a total of 24 units to enlarge the data storage capacity. |

The acceptance committee considered and passed resolutions as follows;

CCH Acceptance Committee Meeting No. 2/2015 on November 5, 2015 the BSV Consortium explained reasons and necessities for the equipment replacement, and offered the proposed equipment including the comparison of properties. The committee considered the matter and agreed that the proposed equipment was of newer version and more effective than the existing one; therefore, they approved the BSV's request and asked them to prepare pricing comparison document and present it in the next Committee Meeting.

CCH Acceptance Committee Meeting No. 3/2015 on November 25, 2015 the BSV Consortium presented the equipment pricing comparison, and PMS Consulting Group is assigned to consider the appropriate pricing.

CCH Acceptance Committee Meeting No. 4/2015 on November 30, 2015, the PMS Consulting Groups informed that they considered the pricing comparison document and found that the proposed equipment prices were higher than the existing ones, but the BSV Consortium still confirmed through a letter to purchase them at the prices specified in the contract. The consultants found that it was for the government benefits. The Committee Meeting considered the price comparison document and the consultants' opinion, and have the resolution to agreed that the BSV Consortium can purchase the equipment, and assigned the OTP to act as a coordinator for the amendment of contract.

#### 2.1.4 Testing Documents

The CCH testing documents are divided into;

1. Test Plan
2. Test Procedure
3. Test Result

The testing performed in the Establishment of the Central Clearing House Project is divided into;

1. Acceptance Test which consists of;

- Internal Functional Acceptance Test
- Factory Acceptance Test
- Internal System Integration Test
- Onsite Test
  - Installation Test
  - Internal Performance Test

2. Onsite Commissioning Test

- Prototype Test
- System Integration Test

- Trial Run
- Front-End Integration Test

Regarding progress at the end of December 2015, the BSV Consortium submitted the subsystem test procedure documents to the OTP and the PMS Consulting Group, and the PMS Consulting Group's opinion is summarized in **Appendix A**.

### 2.1.5 Training Documents

The training documents consist of;

1. Technology Transfer – the training aims to educate the participants on the CCH Contractor's technology which is used in the system development and the Contractors' experiences.
2. Training – the training documents are made for the users so that they are able to effectively use and maintain the CCH. The training is divided into 2 courses as follows;
  - 1) The CCH Operating Courses to create understanding about responsibility, activity and methods of the CCH's usage and management
  - 2) The CCH Maintenance Courses to create understanding about responsibility, activity and methods of the CCH's maintenance

Regarding progress at the end of December 2015, the BSV Consortium submitted the technology transfer and training plans to the OTP and PMS Consulting Group, and the PMS Consulting Group considered the matter. Their opinion over the plans is shown in **Appendix A**.

### 2.1.6 Operating and Maintenance Manual

The operating and maintenance manual provided for the Establishment of the Central Clearing House Project will be in both Thai and English versions. The documents are under preparation at the moment.

## 2.2 Coordination Meeting Attendance

To make the project running in accordance with the schedule and requirements and responding to demands of the government, transit and non-transit service providers, the OTP, the PMS Consulting Group and the BSV Consortium arrange the coordination meeting with the third party

and service providers. The workshop is arranged to publish the works result and gather related parties' suggestion and feedback which will be adapted and applied to the system design, so that the developed CCH is able to respond to the government's policies, service provider demands and the public benefits as much as possible.

Regarding the Establishment of the Central Clearing House Project's coordination meetings arranged during the project consist of the technical meeting, the public hearing , the workshop, project coordination meeting, and CCH Acceptance Committee Meeting. The meeting details are shown in **Table 3-2**.

Table 2-6 Details of the Establishment of the Central Clearing House Project Meetings

| No. | Date      | Meeting                 | Related person | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----|-----------|-------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | 17 Feb 15 | Project Kickoff Meeting | OTP/PMS/BSV    | OTP, PMS consulting group and BSV Consortium attended the project kickoff meeting. The BSV Consortium presented the project's implementation plan and main delivery schedule, and introduced the project's staff and coordinators.                                                                                                                                                                                                                                                                                |
| 2.  | 11 Mar 15 | Technical Meeting No. 1 | OTP/PMS/BSV    | <p>According to accelerating policy of the Ministry of Transport, the OTP, the PMS consulting group and BSV Consortium arrange the meeting to discuss on a guideline and framework in order to complete the common ticketing structure design as soon as possible.</p> <p><u>The Meeting's Opinion:</u> The BSV Consortium should issue the card data structure within April 2015. The PMS consulting group also arrange the card structure workshop to acknowledge effects and opinion from related parties.</p> |

| No. | Date      | Meeting                 | Related person     | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----|-----------|-------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.  | 9 Apr 15  | Technical Meeting No. 2 | OTP/PMS/BSV        | <ul style="list-style-type: none"> <li>The BSV Consortium informed the meeting that their design process would be delayed, since the conclusion over card data requirements still could not be concluded.</li> </ul> <p><u>The Meeting's Opinion:</u> The PMS Consulting Group arrange the workshop with the BMTA in order to obtain necessary information for the design as soon as possible. Regarding the financial report, since there was not CTC in place, the OTP and PMS Consulting Group had to consider and verify the report.</p> <ul style="list-style-type: none"> <li>Related parties suggested about the common ticketing standard that more than a single technology or manufacturer should be allowed.</li> </ul> <p><u>The Meeting's Opinion:</u> The BSV Consortium explained that such task was not in the scope. However; if the OTP wanted the common tickets to be compatible with other cards using other technologies, related parties can study those card structures for possibility and limitation, and then inform the BSV Consortium for further design modification.</p> |
| 4   | 27Apr 15  | Public Hearing          | OTP/PMS/BSV/<br>SP | The PMS consulting group and BSV arranged a public hearing seminar about the common ticket's overview and initial design to gather the opinion and suggestions for the design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 5   | 7 May 15  | Workshop                | OTP/PMS/BSV/<br>SP | <p>The PMS consulting group and BSV arranged the workshop pertaining to the common ticket details and the overall CCH System for related parties' staff in order to gather and use their opinion and suggestions for the design.</p> <p>According to this workshop, the PMS Consulting Group and BSV Consortium modified the details design to accord with the opinion and suggestions gathered from the workshop;. 1. Increasing the number of system transfer from 2 times to 3 times to correspond with people transfer behavior, and 2. Maintaining the orders of card products as specified in the OTP's requirements, and CTC was allowed to modify as appropriate</p>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6   | 14 May 15 | Technical Meeting No. 3 | OTP/PMS/BSV        | <p>This Technical Meeting No. 3 discussed the following matters;</p> <ol style="list-style-type: none"> <li>1. Determination and definition of the PMS Consulting Group's comment categories</li> <li>2. Implementation of non-transit business' Front-end</li> <li>3. Issuer's Float management</li> <li>4. Card product usage sequences</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

| No. | Date       | Meeting                          | Related person                                   | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|------------|----------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | 19 May 15  | Project Coordination Meeting     | OTP/PMS/BSV/ CPEX/BMTA                           | Coordination Meeting discussed fare collection concept through Automatic Fare Collection System for Public Buses and Chao Phraya Express Boats, and listened to BMTA and Chao Phraya Express Boat's e-money card implementation plan.                                                                                                                                                                                                                                                                           |
| 8   | 8 June 15  | Project Coordination Meeting     | OTP/PMS/BSV/ Seoul City Government               | OTP, PMS consulting group and BSV Consortium attended the meeting to listen to the Common Ticketing development experiences in Seoul, South Korea, which was presented by Seoul City Government's representatives.                                                                                                                                                                                                                                                                                              |
| 9   | 15 June 15 | Technical Meeting No. 4          | OTP/PMS/BSV                                      | Follow up design documents falling behind the submittal schedule that submitted by the BSV Consortium.                                                                                                                                                                                                                                                                                                                                                                                                          |
| 10  | 13 July 15 | CCH Acceptance Committee Meeting | OTP/PMS/BSV                                      | In this meeting, BSV Consortium presented the scope of implementation and timeframe according to the Contract, including the current progress to the CCH Acceptance Committee.                                                                                                                                                                                                                                                                                                                                  |
| 11  | 22 July 15 | Technical Meeting No. 5          | OTP/PMS/BSV                                      | Discuss a management plan in a case of multiple card issuers. The meeting's resolution appointed BSV Consortium to proposed the alternatives and each alternative's pros and cons.                                                                                                                                                                                                                                                                                                                              |
| 12  | 9 Sep 15   | Workshop                         | OTP/PMS/BSV/SP                                   | PMS Consulting Group and BSV Consortium arranged the workshop on the results of common ticketing and CCH system details design for the related parties' staff, in order to explain the design result from after gathered the suggestion from the workshop on May 7, 2015. The BSV Consortium improved the design according to the suggestions, and presented the result which could be used as the common ticketing system standard. Moreover, the attendees could apply it to their own designs in the future. |
| 13  | 9 Sep 15   | Technical Meeting No. 6          | OTP/PMS/BSV                                      | To summarize the PMS Consulting Group suggestions on BSV's design documents and accelerate design completion in order to submit it to the OTP as soon as possible                                                                                                                                                                                                                                                                                                                                               |
| 14  | 6 Oct 15   | Project Coordination Meeting     | OTP/PMS/BSV/ Ministry of Finance's working group | To attend and listen to the development and implementation details of the ITMX (Interbank Transaction Management and Exchange), which is related to e-money card payment standard, and ideas for Any ID (anonymous) payment project implementation from the Minister's consultant group in order to study the effects on Common Ticketing System Implementation and its involvement with both projects.                                                                                                         |

| No. | Date      | Meeting                          | Related person   | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----|-----------|----------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15  | 27 Oct 15 | Project Coordination Meeting     | OTP/PMS/BSV/BOT  | To listen to e-money card business guideline over rules, regulations and implementation procedures required by the CTC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 16  | 5 Nov 15  | CCH Acceptance Committee Meeting | OTP/PMS/BSV      | <ul style="list-style-type: none"> <li>The chairman of CCH Acceptance Committee informed the PMS Consulting Group and BSV Consortium to accelerate the Establishment of the Central Clearing House Project completion according to the government's policy to push forward the common ticketing system concretely.<br/><u>The Meeting's Opinion:</u> The PMS Consulting Group and BSV Consortium revised the implementation plan to accelerate the task and presented it in the next Committee's meeting.</li> <li>BSV Consortium presented the project management and design submit to the OTP for approval for the 1<sup>st</sup> Milestone<br/><u>The Meeting's Opinion:</u> The CCH Acceptance Committee checked documents sent by BSV Consortium and gave opinion and suggestions to BSV Consortium to improve and complete the documents.</li> <li>BSV Consortium proposed to change some equipment for used in the CCH project, since the manufacturers inform that they were discontinued.<br/><u>The Meeting's Opinion:</u> The CCH Acceptance Committee considered the comparison of equipment specifications between those specified in the Contractt and the proposed ones. They agreed that the proposed equipment was comparable to or better than the existing one. Therefore, the proposal was approved and assigned the BSV Consortium to submit the manufacturing cancellation letter and price comparison including price confirmation letter as specified in the a Contractt.</li> </ul> |
| 17  | 10 Nov 15 | Project Coordination Meeting     | OTP/PMS/BSV/BMTA | The BMTA's staffs attended the meeting to listen to concept about the Fare Collection System using e-money card, common ticket participating guideline, and progress of Establishment of the Central Clearing House project, from the OTP, PMS Consulting Group and BSV Consortium.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| No. | Date      | Meeting                          | Related person | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----|-----------|----------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 18  | 25 Nov 15 | CCH Acceptance Committee Meeting | OTP/PMS/BSV    | <ul style="list-style-type: none"> <li>The CCH Acceptance Committee summarized the opinion and suggestions on the BSV Consortium's 1<sup>st</sup> Milestone<br/><u>The Meeting's Opinion:</u> The committee agreed that the number of issuers should be increased to more than 10 from the previous at maximum of 10 issuers, and assigned the BSV to search for additional methods and rationale for such increment.</li> <li>According to the Committee Meeting No. 3/2015 on November 25, 2015, the BSV presented pricing comparison documents between the equipment specified in the Contract and the proposed ones.<br/><u>The Meeting's Opinion:</u> The PMS Consulting Group was assigned to consider for an appropriate pricing.</li> </ul>                                                                                                                                                                                                                                               |
| 19  | 30 Nov 15 | CCH Acceptance Committee Meeting | OTP/PMS/BSV    | <ul style="list-style-type: none"> <li>The BSV presented a principle for increasing the issuer number to another 20 afterwards. Such action did not affect the implementation schedule already propose to the OTP which considered that it was feasible.<br/><u>The Meeting's Opinion:</u> The meeting approved this section of design.</li> <li>The PMS Consulting Group told the committee that they already considered the price comparison document and found that the proposed equipment' prices were higher than the existing ones, but the BSV assured through a letter that it would be purchased at the prices specified in the Contract, and they thought that it was for the government sector's benefits.<br/><u>The Meeting's Opinion:</u> The meeting considered the comparison document and PMS consulting group's opinion. The Meeting's resolution approved BSV to purchase the proposed equipment, and OTP was assigned as a coordinator for the Contract amendment.</li> </ul> |



## Chapter 3 Central Clearing House and Common Ticketing System Design

### 3.1 Central Clearing House's Particular Specifications

The Establishment of the Central Clearing House (CCH)'s contract documents on CCH technical requirements specify project scope of work, system components, functions and efficiency. It consists of General Scope and Service Requirements (GSSR), General Specification (GS) and Particular Specification (PS). It can be summarized as follows;

#### 3.1.1 General Scope and Service Requirements (GSSR)

It specifies all scope of work of the CCH Contractor and other common ticketing system related contractors, so that they understand the project's overview, works to be done and necessary coordination.

#### 3.1.2 Particular Specification (PS)

It shows the CCH's technical particular specifications that has been specified the CCH's necessary functions to be provided by the contractors, including the card structure in order to support business rules as specified in the General Specification (GS) documents. The particular specifications can be summarized as follows;

##### 3.1.2.1 System's Components

The CCH is a conceptual model which explains the CCH's interfacing format at the highest level through showing the interfacing details between the CCH and transit and non-transit service providers. The CCH shall be designed to contain the following subsystem's functions as follow;

- 1) Settlement system processes card usage data, both travelling and making payment, and also apportion for settlement for other service providers or card issuers.
- 2) Card system is divided into 2 sections; the first one is called Card Issuance System (CIS) which is responsible for card issuance, card life cycle management and verify various transactions, and the second one is called Card Management System (CMS) which collects important data and top-up and refund-related services.
- 3) Infrastructure Operating Management System (IOMS) acts as a channel for data transfer between the CCH systems and the service providers' Front-Ends. It also verifies steps of data transfer between the CCH and the Front-Ends.

- 4) Interface systems interfacing message between the CCH's subsystems, and between the CCH's systems and service providers' Fare Collection Systems.

### 3.1.2.2 The CCH's Main Responsibilities

The CCH is required to perform the following responsibilities;

- 1) Transaction clearing and settlement: collection/aggregation, insert /verification, claim and apportionment, and payment with ability to recover missing transactions
- 2) Settlement management and operation Functionality : common information, fare information, commission fee and SP information
- 3) Portal Services for SP, operation staff, and government. If required by the Employer, a separate portal for Card user.
- 4) Card Management and Issuance Functionality : including Card Issue, key, authentication, Blacklist information management
- 5) Reload and Refund Functionality
- 6) Purchase Functionality
- 7) Ledger management Functionality
- 8) SP Information Management Functionality
- 9) Equipment Management Functionality (EMF)
- 10) Operation Information Management Functionality (OIMF)
- 11) Data Transmission Functionality
- 12) Interface Functionality
- 13) Financial Functionality

### 3.1.2.3 System's Capability Specifications, Capacity and Extensibility

The Central Clearing House is required to be effective in order to support the common ticketing usage and expand the system after the common ticketing usage is increased, at least as follows;

- 1) The CCH system shall be capable of handling at least 10 million transactions/day at commencement.
- 2) The CCH system shall be capable of expanding to handling 20 million transactions/day
- 3) The system shall be designed to accommodate SPs in Thailand.
- 4) The system has to support at least 1,000 line/routes for Transit Service Providers.

- 5) Each Line/Route shall have a Line ID
- 6) Each Line/Route shall allow at least 20 ASCII characters as a Line/Route Description.
- 7) The system has to support least 250 stations for each Rail Line and at least 500 stops (250 stops each direction) for each Bus Route
- 8) Each station/stop within the line shall have a Station ID to identify the station/stop.
- 9) Each station/stop shall use at least 20 ASCII characters as a station/stop Description.
- 10) Each station/stop shall use at least 4 ASCII characters Station Short Code
- 11) End of day processing duration does not exceed 3 hours.
- 12) It has to be able to store data online for 6 months.
- 13) It has to be able to store data offline for 5 years.
- 14) It has to design the service providers' Front-End configuration data.
- 15) It has to design the interface between the CCH systems and service providers' Front-Ends.
- 16) It has to design transaction data to be received from the service providers' Front Ends.
- 17) It has to specify data required for financial reports and payment reports.
- 18) It has to design security systems.

#### 3.1.2.4 Contactless Smart Card's Particular Specifications

- 1) Contactless Smart Card shall be certified to at least CC-EAL 4+ for both hardware and software, and a certification to CC-EAL 5+ or better for hardware is highly desirable.
- 2) Contactless Smart Card shall be able to support 3-DES and AES data encryption.
- 3) Contactless Smart Card shall be implemented to use with the card readers currently used in the mass transit systems in Thailand. Card reader updates are generally not required, but it is necessary for the software/firmware updates, including SAM for suitable in actual work.
- 4) Contactless Smart Card has to support clearing and top-up devices used in shops and convenient stores in Thailand. Moreover, the hardware should not require an update, but the software/firmware and SAM should be updated for suitable in actual work.
- 5) The proposed Contactless Smart Card file structure and layout shall provide complete and secure segregation of any private areas reserved for the use of Service Providers.

- 6) A common area for purse, transaction history (including transfers) and other shared data shall be provided; the data to be stored in the common area shall be agreed with the Employer.
- 7) the data layout shall be designed such that only a single Application is written to during a transaction. This is to reduce the possibility of transaction tearing when a passenger removes his card before a final 'commit' command has completed.
- 8) Contactless Smart Card shall have at least 8 kilobytes space of accessible data storage.
- 9) Collector and tourist cards shall be special anonymous adult CSCs printed with special images and bundled with an initial purse value. All collector and tourist cards shall be ineligible for refund of the bundled value, but shall be eligible for replacement with a normal CSC if they become corrupted.
- 10) The common tickets shall be capable of use in multiple transit modes, including (but not limited to) metro rail (BTS, Airport Link and MRT), public bus, river ferry, express boat ferry, public van, normal rail, high speed rail, expressway, Bus Rapid Transit, as well as various retail and leisure. Expansion to parking systems, taxis, private van and other modes both transit and non-transit shall be allowed for in Contactless Smart Card layout design.
- 11) shall be capable of expansion to support co-branded products, such as co-branded debit/credit cards from commercial banks with international payment standards (e.g. EMV compatible payment cards). The CCH system shall allow the owners of the different brands to be custodians of their own floats.
- 12) The design of common ticketing data layout shall be such that porting of this layout to alternative media, such as NFC devices, shall be achievable at minimum cost.

### 3.1.3 General Specification (GS)

General Specification (GS) to be followed by the contractors consists of work plan, progress report, design specifications, necessary tests, test result submission, preparation of spare parts and system guarantee.

In the design and implementation of the common ticketing system and the CCH, it has to be designed to support business rules specified in the Appendix 6 of General Specification (GS).

The business rules can be summarized as follows;

- 1) Card management specifications have to be specified, i.e. card usage policy, card usage rules, and other card related specifications such as card issuance and distribution, etc.
- 2) Common tickets have to be divided into three types; Anonymous, Registered and Personalized.
- 3) Common tickets have to support concessionary types, such as adults, student/college student and elderly person, etc. includes staff card.
- 4) Card products consist of e-purse, common pass product, fixed journey product and loyalty products.
- 5) It has to support fare discount structure for transfer trips with the following discount conditions as follows;
  - Total distance not exceeding 20 kilometers
  - Transfer trip is made within 30 minutes.
  - Support two transfer trips (3 traveling trips)

### 3.2 Summary of Common Ticketing System Designs

The BSV Consortium, the CCH Contractor, has submitted the design documents in a total of 57 documents consisting of;

1. Architecture Documents
2. Requirements Documents
3. Interface Documents
4. Design Documents

The BSV Consortium has already submitted all design documents, and the PMS Consulting Group has considered all documents according to specifications specified in CCH's TOR, Appendix 6, Business Rules, of General Specification, and Particular Specification. List of design documents submitted and revised according to the OTP and PMS Consulting Group's suggestions by the BSV Consortium is as follows;

Table 3-1 List of Design Documents for the Common Ticketing System and the CCH System\

| No.  | Document Number         | Document                                                               | Rev.. |
|------|-------------------------|------------------------------------------------------------------------|-------|
| 1    | Architectural Documents |                                                                        |       |
| 1.1  | BSVV.00001              | System Architecture                                                    | 2.0   |
| 1.2  | BSVB.00010              | Technical & Network Architecture                                       | 2.0   |
| 1.3  | BSVV.00002              | System Security Architecture                                           | 3.0   |
| 1.4  | BSVB.00001              | NC Card Data Definition                                                | 3.0   |
| 1.5  | BSVB.00011              | Configuration Parameters                                               | 2.0   |
| 1.6  | BSVB.00012              | Transaction Data Definition                                            | 2.0   |
| 1.7  | BSVB.00013              | NC Card Business Rules                                                 | 2.0   |
| 2    | Interface Documents     |                                                                        |       |
| 2.1  | BSVB.00025              | Bank Interface Specification                                           | 1.0   |
| 2.2  | BSVV.00006              | OTP CCH to Operator Interface Specification                            | 2.0   |
| 2.3  | BSVB.00026              | Equipment Initialization Interface Specification                       | 2.0   |
| 2.4  | BSVV.00015              | Online Enquiry Subsystem Interface Specification                       | 2.0   |
| 2.5  | BSVB.00106              | Cardholder Website Payment Gateway Subsystem Interface Specification   | 1.0   |
| 2.6  | BSVS.00079              | SAM Interface Specification                                            | 2.0   |
| 3    | Design Documents        |                                                                        |       |
| 3.1  | BSVB.00039              | Access Control Subsystem Design Specification                          | 2.0   |
| 3.2  | BSVB.00040              | Action List Management Subsystem Design Specification                  | 2.0   |
| 3.3  | BSVB.00041              | Autoload Management Subsystem Design Specification                     | 2.0   |
| 3.4  | BSVB.00042              | Card Inventory Management Subsystem Design Specification               | 1.0   |
| 3.5  | BSVS.00009              | Card Initialization and Personalization Subsystem Design Specification | 2.0   |
| 3.6  | BSVB.00043              | Communications Subsystem System Design Specification                   | 2.0   |
| 3.7  | BSVB.00116              | Configuration Data Management Subsystem Software Design Specification  | 2.0   |
| 3.8  | BSVB.00044              | Device Management Subsystem Software Design Specification              | 2.0   |
| 3.9  | BSVV.00009              | Financial Management Subsystem Software Design Specification           | 2.0   |
| 3.10 | BSVB.00045              | Host Security Management Subsystem Software Design Specification       | 1.0   |
| 3.11 | BSVV.00010              | Issuer Subsystem Design Specification                                  | 2.0   |
| 3.12 | BSVS.00010              | Key Management Subsystem Design Specification                          | 2.0   |
| 3.13 | BSVV.00016              | Online Enquiry Subsystem Design Specification                          | 1.0   |

| No.  | Document Number | Document                                                   | Rev.. |
|------|-----------------|------------------------------------------------------------|-------|
| 3.14 | BSVB.00046      | Report Management Subsystem Design Specification           | 2.0   |
| 3.15 | BSVB.00047      | Systems Management Subsystem Software Design Specification | 2.0   |
| 3.16 | BSVS.00011      | Central Clearing House Equipment Rack Plan                 | 2.0   |
| 3.17 | BSVB.00048      | Central Clearing House Network Design                      | 2.0   |
| 3.18 | BSVB.00049      | Central Clearing House Server System Design                | 2.0   |
| 3.19 | BSVV.00011      | Cardholder Website Software Design Specification           | 2.0   |
| 3.20 | BSVB.00115      | SP Website Software Design Specification                   | 2.0   |
| 3.21 | BSVB.00107      | Payment Gateway Subsystem Interface Specification          | 2.0   |
| 3.22 | BSVS.00083      | SAM Design Specification                                   | 2.0   |
| 3.23 | BSVB.00104      | System security architecture Design Specification          | 2.0   |
| 3.24 | BSVS.00084      | Reload and Refund Machine Software Design Specification    | 2.0   |

According to all design documents submitted by the BSV Consortium, the design of common ticketing system and the CCH can be summarized and classified into common ticketing system standards which will be used by the OTP for publish as the national standard to Transit and Non-transit Service Providers for implement or modified their Fare Collection System in order to support the common ticketing system. In addition, the CCH design that consists of system architecture, system security and interface with related parties, as follows;

### 3.2.1 National Standard for Common Ticketing System

This section is specify the Business Rules, card data structure design, data format send from service providers to CCH, and data format send from CCH to service providers.

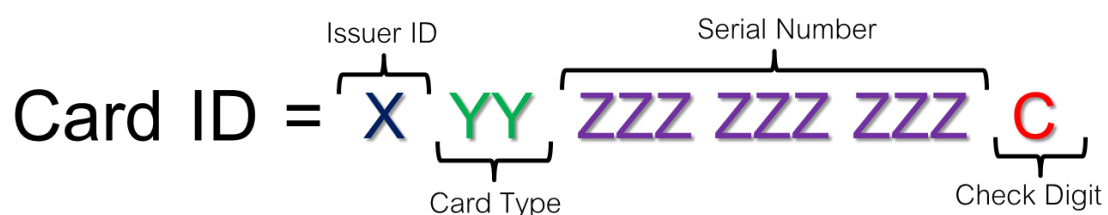
#### Business Rules

Business Rules show details of agreements, terms and conditions of common tickets. The transit and non-transit service providers who wish to receive payments for fare, fee, goods and service fee through the common tickets have to take this Business Rules to complement and support their Fare Collection System implementation or modification, in order to support such payment services via common tickets.

Business Rules for the Establishment of the Central Clearing House project specify technical details related to the common ticket uses such as Card ID, Card Type, Card Product, Functions, etc. This also covers card usage's terms and conditions and card control. The Business rules details can be summarized as follows;

common ticket's Card ID contains 13 digits. The first digit refers card issuer's ID from 0 – 9. Cards issued by CTC or co-branded cards' issuer ID is 1, while the issuer ID for the other card issuers is 2 – 9. The second and third digits refer to Card Type ranging from 00 – 63. The fourth and twelfth digits refer to card's Serial Number ranging from 000,000,000 - 999,999,999. The thirteenth digit refers to Check Digit and it is shown only on card.

Chart 3-1 Card ID



According to the workshop and the technical meeting, it could be observed that the card ID support only 10 card issuers, so it should have design or find out the alternative method in a case that more than 10 agencies are interested to participate as card issuers. The PMS Consulting Group and BSV receive the observations and discussed for possible alternative method without any effect on the project and concluded that if there are more than 10 card issuers in the future, the system will be able to support another 20 issuers through the following method;

1. The first 10 issuers use the card ID's first digit (ranging from 0-9) as the card issuer's number, while the second and third digits show the card's type as follows;

Chart 3-2: Card ID for the 1<sup>st</sup> – 10<sup>th</sup> Card Issuers

| Card ID | X<br>(Issuer ID) | Y <sub>1</sub> Y <sub>2</sub><br>(Card Type) | ZZZ ZZZ ZZZ<br>(Serial No.) | C<br>Check Digit |
|---------|------------------|----------------------------------------------|-----------------------------|------------------|
|         | 0                | 00                                           | 000 000 000                 |                  |
|         | 1                | 01                                           | 000 000 001                 |                  |
|         | 2                | 02                                           | 000 000 002                 |                  |
|         | 3                | .                                            | .                           |                  |
|         | 4                | .                                            | .                           |                  |
|         | 5                | .                                            | .                           |                  |
|         | 6                | .                                            | .                           |                  |
|         | 7                | .                                            | .                           |                  |
|         | 8                | .                                            | .                           |                  |
|         | 9                | 63                                           | 999 999 999                 |                  |
| Total   | 10 Issuers       | 64 Types                                     | 999,999,999 Cards           |                  |

2. The eleventh card issuer onwards get the first (ranging from 2-7 and 9), and the second digit (ranging from 7-9) which show the card issuer's number, and the third digit (ranging from 0-9) shows the card's type, as follows;

Chart 3-3 Card ID for the 11<sup>th</sup> – 30<sup>th</sup> Card Issuers

| Card ID | $X Y_1$<br>(Issuer ID) | $Y_2$<br>(Card Type) | $ZZZ ZZZ ZZZ$<br>(Serial No.) | $C$         |
|---------|------------------------|----------------------|-------------------------------|-------------|
|         | 27                     | 0                    | 000 000 000                   | Check Digit |
|         | 28                     | 1                    | 000 000 001                   |             |
|         | 29                     | 2                    | 000 000 002                   |             |
|         | 37                     | 3                    | .                             |             |
|         | 38                     | 4                    | .                             |             |
|         | 39                     | 5                    | .                             |             |
|         | 47                     | 6                    | .                             |             |
|         | 48                     | 7                    | .                             |             |
|         | 49                     | 8                    | .                             |             |
|         | 57                     | 9                    | .                             |             |
|         | 58                     |                      | .                             |             |
|         | 59                     |                      | .                             |             |
|         | 67                     |                      | .                             |             |
|         | 68                     |                      | .                             |             |
|         | 69                     |                      | .                             |             |
|         | 77                     |                      | .                             |             |
|         | 78                     |                      | .                             |             |
|         | 79                     |                      | .                             |             |
|         | 97                     |                      | .                             |             |
|         | 98                     |                      | 999 999 999                   |             |
| Total   | 20 Issuers             | 10 Types             | 999,999,999 Cards             |             |

As for types of cardholders, common tickets created in the CCH Implementation project can be divided into 3 types as follows;

- (1) Anonymous – This card type does not contain personal data. Cardholder can issue the card at a designated sale point. If the card is lost, its remaining value cannot be refunded or replacement.
- (2) Register – This card type does not contain personal data. Cardholder can issue the card at a designated sale point. When the card is registered, the registered data will be kept in the CCH. If the card is lost, the cardholder can refund the remaining value. The cardholder also can request for issue a new card in case the cardholder identified the lost card's number correctly.
- (3) Personalize – This card type has language and birth date data written on the card and kept other personal data at the CCH. The CTC will issues this card type based on conditions, e.g. the card is issued for low-income people or issued as ID card or employee's card. After the card is received, the cardholder has to show his or her identity document to activate the card at a designated point. If the card is lost, the cardholder is able to refund the remaining value or request for a replacement.

Regarding particular data related to common tickets and card functions, the details are as follows;

- (1) Value top-up, Pass top-up, upgrade or penalty can be pay by cash or credit/debit card.
- (2) Common ticket's standard products are Common Purse Product, Common Pass Product, Fixed Journey Product and Common Loyalty Product.
- (3) Cardholder will receives fare discount for transfer trips when the payment is made through Common Purse and traveling according to the scheme and conditions specified by the CTC include Distance Travel Condition, Transfer Time Condition and Number of Transfer.

Regarding the specification to control Common Ticket usage such as Common Card Status Control, Blacklist Control, Card Expiry Date Control, Minimum Value for Entry Control, etc., and Card Operations such as card sale, new card value, top-up, replace/refund, etc., will be determined by the CTC, the system manager.

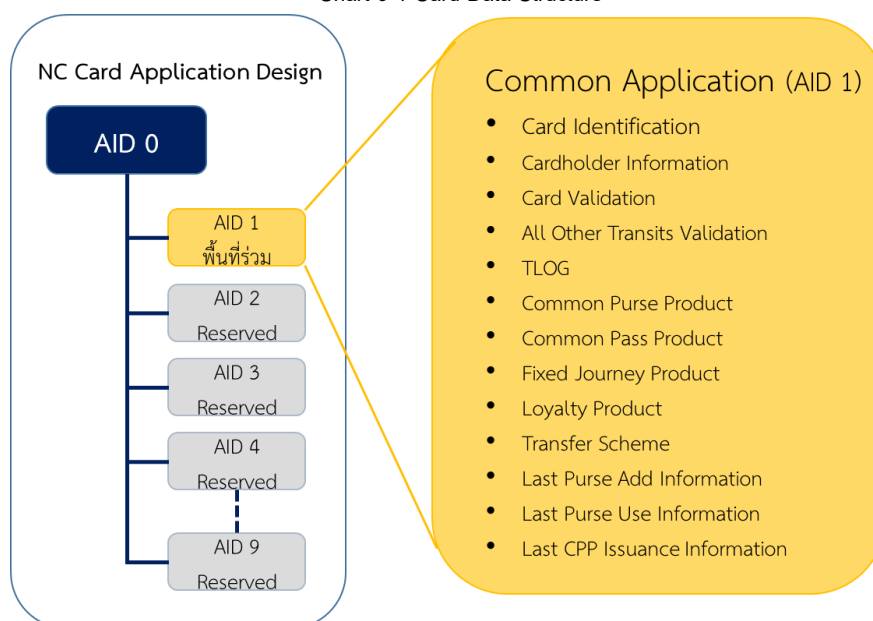
## Card Data Structure

Common ticket is designed data storage area or application into 9 applications (AID 1-9); AID 1 is a common area or common application, and AID 2-9 are specific area for service providers. The CCH implementation project's card data structure is designed in the common area or application. The data contained in the common area is as follows;

- (1) *Card Identification* is a specific numbers for each common ticket which will be recorded in card at the Card Initialization stage. The card identification format conforms to the Business Rules.
- (1) *Cardholder Information* is cardholder's personal data which will be recorded for the Registered Card.
- (2) *Card Validation* is the Service providers' data that allow to be accessed for validation before the card is used.
- (3) *Each Transit Operator Validation* is the data validation for related mass transit service providers.
- (4) *Transaction Log* is the records of the latest transactions for 16 travel or card usage transaction.
- (5) *Common Purse* is the e-money used for transit fare payment and goods payment for retail shops. The CTC is able to determine the maximum e-money value to be stored in cards. The e-money will be recorded in satang in order to cover goods payment methods currently in use.
- (6) *Common Pass Product* is The product used for travel on all transit systems that agree and cooperate to provide services and receive payment by using the Common Pass Product, which is able to determine both trip based and period based types. The system is designed to support the common pass product determination up to 64 types.
- (7) *Fixed Journey Product* is the product used for travel on all transit systems that agree and cooperate to provide services and receive payment by using Fixed Journey Product. The fare will be deducted from the Common Purse Product and discount will be received when traveling according to the fixed routes.
- (8) *Common Loyalty Product* is the product that records points collected from usage value for reward redeem such as trip redeem, etc.

- (9) *Transfer Scheme* shows traveling details for the service providers to check and give discount according to the trip's conditions.
- (10) *Last Add Information* shows common purse's latest added value through various methods.
- (11) *Last Purse Use Information* shows the latest common purse product usage recorded in Transaction Log.
- (12) *Last Common Pass Issuance Information* shows the latest added Common Pass information through various methods.

Chart 3-4 Card Data Structure



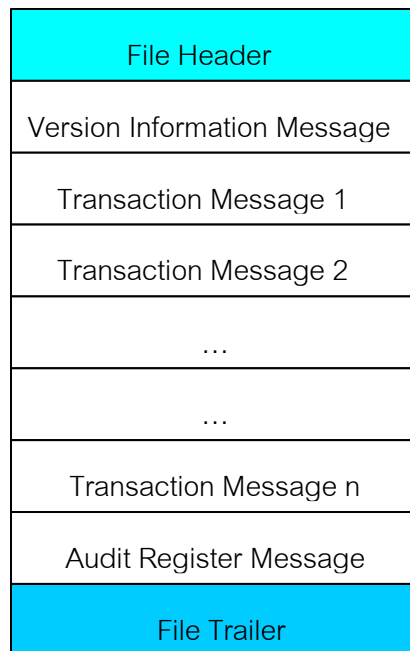
The card structure and data have to be consistent and support the application of Business Rules.

### Transaction Data Definition

Details of Common Ticket's Transaction Data format which is created from card reader/writer are collected and transfer to the CCH for processing and clearing. This covers the following contents;

- (1) Data file structure and naming convention are the specifications for service providers to create the transaction message as mutually agreed.

Chart 3-5 Transaction Data Format



Data type are as follows;

- Initialization
- Card Issuance
- Usage
- Add Value
- Deduction
- Refund and Replacement
- Auto Add Value
- Reversal
- Recover

#### Configuration Parameters

The CCH will create configuration parameter files to be shared among service providers. They will be transferred to service providers' Automatic Fare Collection Systems (AFC), so that the AFC systems will be able to received the payment by Common Ticket according to the CTC's conditions. It covers the following contents;

(1) Format and standard for parameters

SSS\_PPV.XXX

SSS : Target ID

PPP : File Identifier

V : Version

XXX : Destination ID

For example: CTC\_FBLA.SYS

Full Card Blacklist Table is transfer from CTC to Front-end System.

Type of parameters for all service providers and for a particular service provider.

List of Parameters

- Parameter Description
- Service Provider
- Station Topology
- Parameter Data
- Add Value Quota
- Card Sale Parameter Table
- CPP Scheme Table
- Fixed Journey Product Scheme Table
- Blacklist Parameter
- System Usage Data Table
- Transfer Scheme
- Online Reload Request

Table 3-2 Example of Parameters in Common Ticketing System

|                             | 30 Days 15 Trips<br>(since issue date) | 30 Days 15 Trips<br>(since first use) | 1 Day Pass | 3 Days Pass | Seminar   |
|-----------------------------|----------------------------------------|---------------------------------------|------------|-------------|-----------|
|                             | 1                                      | 2                                     | 3          | 4           | 5         |
| Pass Validity Duration Mode | 1                                      | 2                                     | 2          | 2           | 3         |
| Validity Duration           | 30                                     | 30                                    | 1          | 3           | 5         |
| First Use Validity Duration | -                                      | 20                                    | 7          | 7           | -         |
| Fixed Start Date            | -                                      | -                                     | -          | -           | 11-May-15 |
| Fixed End Date              | -                                      | -                                     | -          | -           | 15-May-15 |
| Maximum Allowed Trips       | 15                                     | 15                                    | 4,095      | 4,095       | 4,095     |
| Card Type Allowed List      | 1,2,3,15                               | 1,2                                   | 1          | 15          | 1         |
| Allowed Mode of Transport   | 00000011                               | 00000001                              | 00000011   | 00000001    | 00000011  |
| Sale Price (Baht)           | 500                                    | 400                                   | 200        | 350         | 1,000     |

In addition to the Common Ticket standard as detailed above, the CCH Contractor also propose the specifications of card readers to be used with the designed common ticket, so that the service providers can use them as a guideline for card reader purchasing or a reference for decision making on the AFC modification. The card readers are divided into those for transit and non-transit service providers, as follows;

Table 3-3 Card Readers/Writers Specification for Transit Systems

| Properties of Card Readers/Writers     | Minimum Specifications | Specifications                   |
|----------------------------------------|------------------------|----------------------------------|
| <u>Standard Compliant</u>              |                        |                                  |
| ICC Card                               | ISO 7816               | ISO 7816                         |
| <u>Technical Specification</u>         |                        |                                  |
| Power supply                           | 12 V.                  | 5-12 V.                          |
| Transmission Frequency                 | 13.56MHz               | 13.56MHz                         |
| CPU                                    | 32 bit processor       | 32 bit processor or above        |
| Flash Memory capacity                  | 2 Mbyte                | 512 Mbyte or above               |
| Card/CSC Reader communication distance | ≥ 7 cm.                | ≥ 7 cm.                          |
| Interface                              | RS232, speed ≥115Kbps  | RS232, speed ≥115Kbps            |
|                                        |                        | RS422, speed ≥465Kbps (Optional) |
|                                        |                        | USB (Optional)                   |

| Properties of Card Readers/Writers | Minimum Specifications                    | Specifications                                      |
|------------------------------------|-------------------------------------------|-----------------------------------------------------|
|                                    |                                           | 3G / Wifi / Bluetooth (Optional)                    |
|                                    |                                           | Ethernet (Optional)                                 |
| Card Compliance                    | ISO 14443 TypeA (T=CL) Desfire            | ISO 14443 TypeA (T=CL) or Type A/B/Felica           |
| Hardware Compliance                |                                           | Support EMVCo Level 1                               |
| Speaker                            |                                           | Buzzer or Speaker                                   |
| SAM Slot                           | ISO 7816 T=0/1 Number of SAM Slot 2 slots | ISO 7816 T=0/1<br>Number of SAM Slot $\geq 4$ slots |
| SAM Type                           | Support Native DESFire SAM                | Support Native DESFire SAM, Java SAM, SAM           |
| Special Feature                    | Anticollision                             | Anticollision                                       |
|                                    | Encrypted data transmission 3DES          | Encrypted data transmission<br>3DES or AES          |
| <u>Environmental Specification</u> |                                           |                                                     |
| Operating Temperature              | 0C to +55C                                | 0C to +55C                                          |
| Storage Temperature                | -20C to +60C                              | -20C to +60C                                        |
| RoHs Compliance                    | Support                                   | Support                                             |
| Operating Humidity                 | 80%RH non-condensing.                     | 80%RH non-condensing.                               |

Table 3-4 Card Readers/Writers Specification for Non-Transit Systems

| Properties of Card Readers/Writers     | Minimum Specifications         | Specifications                          |
|----------------------------------------|--------------------------------|-----------------------------------------|
| <u>Standard Compliant</u>              |                                |                                         |
| ICC Card                               | ISO 7816                       | ISO 7816                                |
| <u>Technical Specification</u>         |                                |                                         |
| Power supply                           | 12 V.                          | 5-12 V.                                 |
| Transmission Frequency                 | 13.56MHz                       | 13.56MHz                                |
| CPU                                    | 32 bit processor or above      | 32 bit processor or above               |
| Flash Memory capacity                  | 128 Mbyte or above             | 512 Mbyte or above                      |
| Card/CSC Reader communication distance | 4 cm.                          | $\geq 4$ cm.                            |
| Interface                              | RS232, speed $\geq 115$ Kbps   | RS232, speed $\geq 115$ Kbps            |
|                                        |                                | RS422, speed $\geq 465$ Kbps (Optional) |
|                                        |                                | USB (Optional)                          |
|                                        |                                | 3G / Wifi / Bluetooth (Optional)        |
|                                        |                                | Ethernet (Optional)                     |
| Card Compliance                        | ISO 14443 TypeA (T=CL) DESFire | ISO 14443 TypeA (T=CL) or               |

| Properties of Card Readers/Writers | Minimum Specifications                       | Specifications                                      |
|------------------------------------|----------------------------------------------|-----------------------------------------------------|
|                                    |                                              | Type A/B/Felica                                     |
| Hardware Compliance                |                                              | Support EMVCo Level 1                               |
| Speaker                            |                                              | Buzzer or Speaker                                   |
| SAM Slot                           | ISO 7816 T=0/1<br>Number of SAM Slot 2 slots | ISO 7816 T=0/1<br>Number of SAM Slot $\geq 5$ slots |
| SAM Type                           | Support Java SAM                             | Support Native SAM, Java SAM, DESFire SAM           |
| Special Feature                    |                                              | Anticollision                                       |
|                                    |                                              | Encrypted data transmission<br>(3DES or AES)        |
| <u>Environmental Specification</u> |                                              |                                                     |
| Operating Temperature              | 0C to +45C                                   | 0C to +45C                                          |
| Storage Temperature                | -20C to +60C                                 | -20C to +60C                                        |
| RoHs Compliance                    | Support                                      | Support                                             |
| Operating Humidity                 | 80%RH non-condensing.                        | 80%RH non-condensing.                               |

### 3.2.2 The CCH System Design

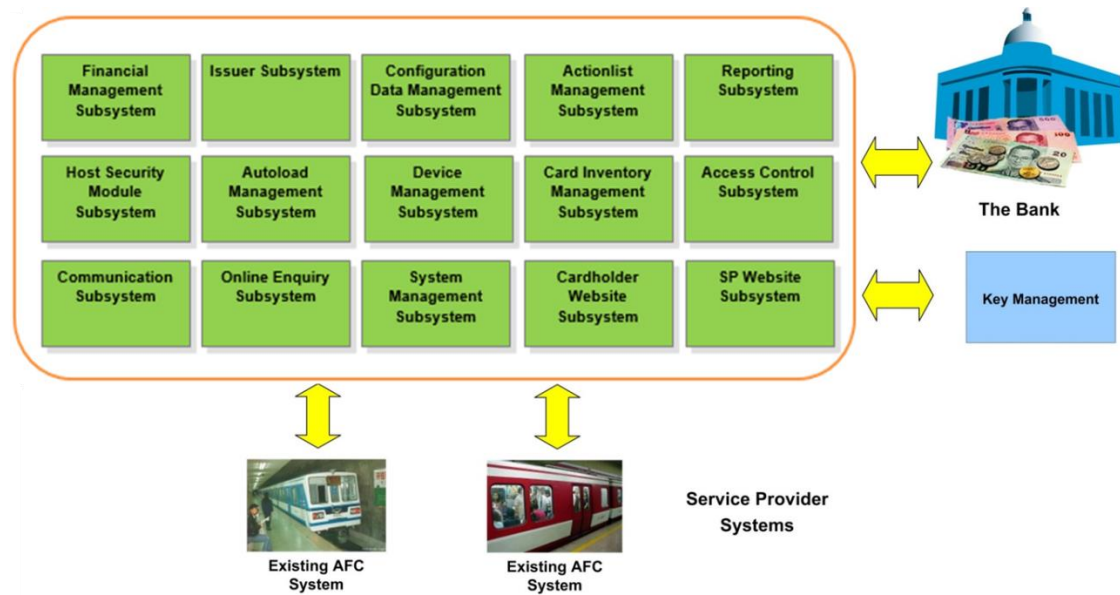
#### 1) The CCH system

Designs of CCH system and system architecture are the system overview showing various subsystems' functions, including specify the function of each component. The designs can be divided into 3 main sections; System Architecture, Security Architecture, and Technical Architecture and Network Design.

#### System Architecture

The CCH Contractor design the system to support common ticket usage, both in transit and non-transit systems. It focuses on an ability to respond to mass transit business whose fare collections are more complicated than those in the non-transit business which focuses on using cards for payments. This covers transit fare management, ticket management in database, interface with equipment and transit systems on the stations, management of clearing and settlement among service providers, and generate reports to be used as information for mass transit fare management and public service planning for both government sectors and service providers.

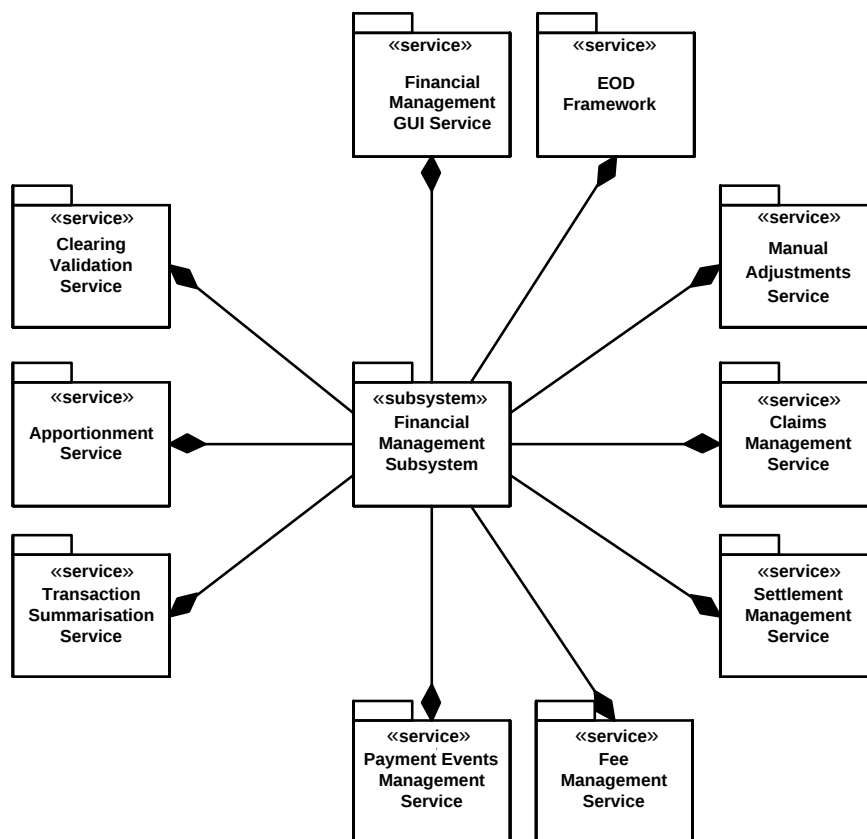
Chart 3-6 System Architecture



The CCH can be divided into subsystems, and each subsystem has separate responsibility for. They can work in collaboration so that the CCH performs in conformity with the OTP's regulations. Each subsystem itself is fully functional, starts from receiving data and sending the processed data to other subsystem for further data processing, or storing the data in the database. The system, which is divided into subsystems, is easy to design and maintenance. Moreover, if any subsystem encounters a problem, it can be fixed promptly. Important subsystems are in total of 15 subsystems as follows;

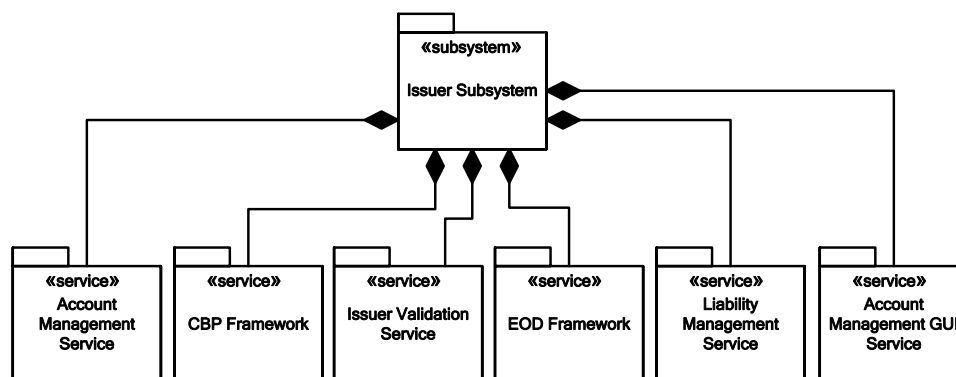
- (1) Financial Management Subsystem is responsible for validate transactions received from service providers, process the transactions, calculate fees, apportionment, settlement and claims received from service providers, e.g. some missing transactions.

Chart 3-7 Overview of Financial Management Subsystem



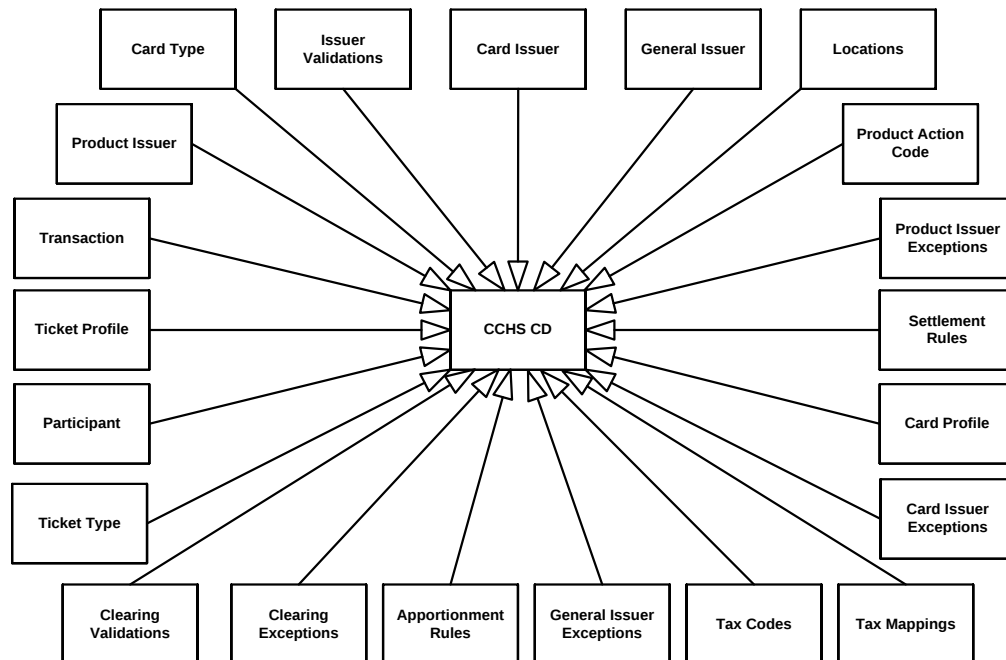
- (2) Issuer Management Subsystem is responsible for validate financial transaction, collect and manage cardholder's data include the expired accounts such as expired card, and manage cardholder's data for Register or Personalized card, and recover missing top-up transaction for lost cards.

Chart 3-8 Overview of Issuer Management Subsystem



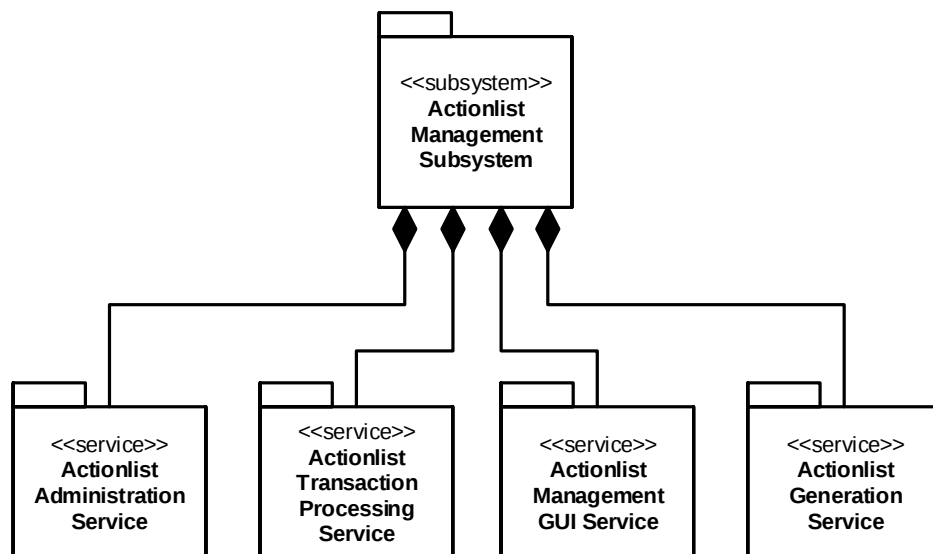
- (3) Configuration Management Subsystem is responsible for managing the configuration data for transfer to service providers' devices to used for card data processing, e.g. card top-up or payment, etc.

Chart 3-9 Overview of Configuration Management Subsystem



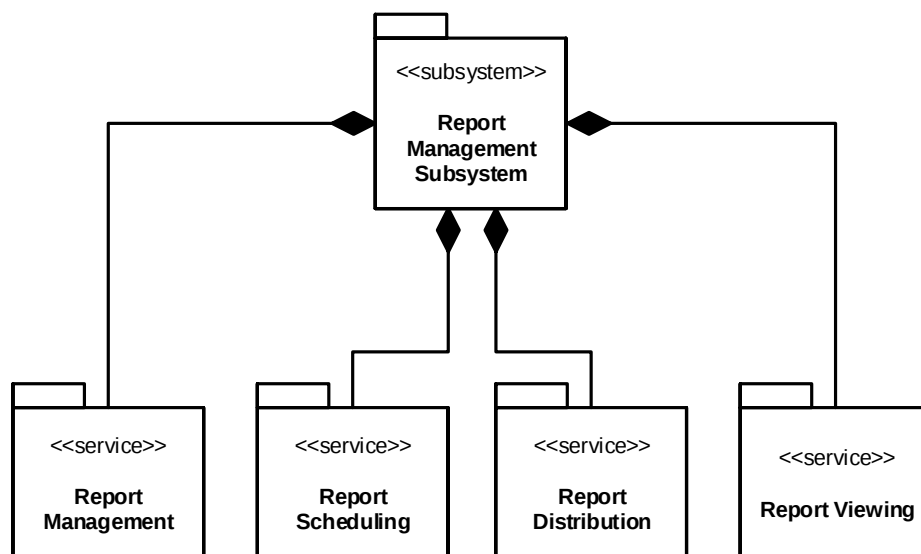
- (4) ActionList Management Subsystem is responsible for managing command list for Common Tickets. The command list will be prepared and transfer to service providers daily (or as required). After a card in the command list is tapped at a device which has already received the command, the command of that card will be activate, e.g. the card will be immediately suspended once it is tapped at the device, etc. After the command is activated, the device will inform the central system to remove such data from the Action List Management.

Chart 3-10 Overview of Action List Management Subsystem



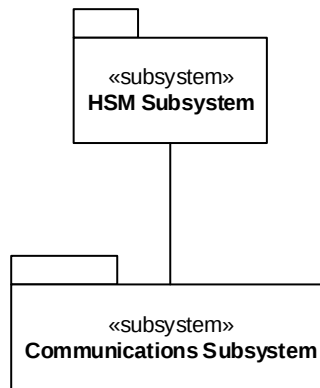
- (5) Report Management Subsystem is responsible for generate the Settlement Reports, e.g. Settlement Report, O/D Report, etc.

Chart 3-11 Overview of Report Management Subsystems



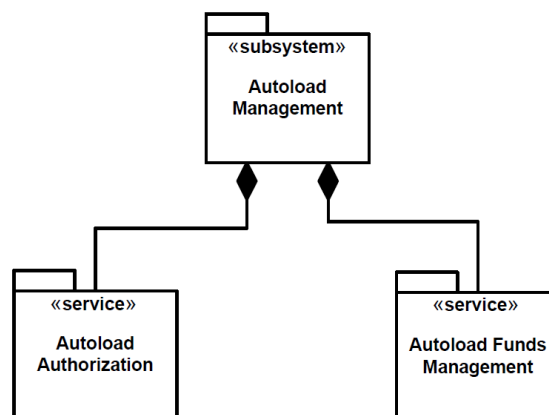
- (6) Host Security Management Subsystem is responsible for validate the transaction transfer from the service providers to the CCH.

Chart 3-12 Overview of Host Security Management Subsystem



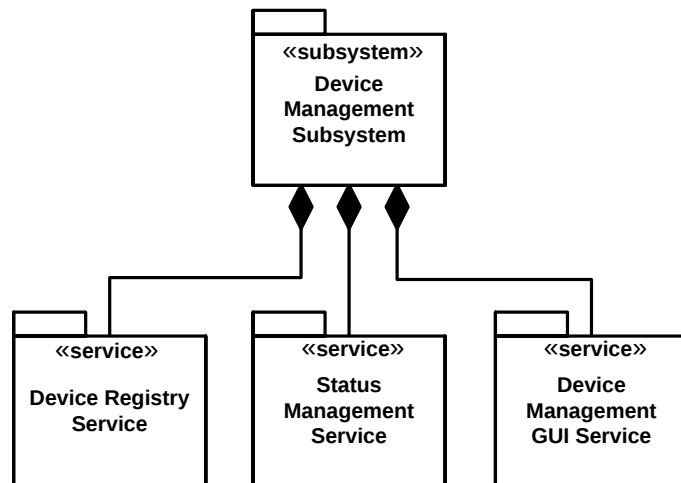
- (7) Autoload Management Subsystem is responsible for manage the automatic top-up for a card.

Chart 3-13 Overview of Autoload Management Subsystem



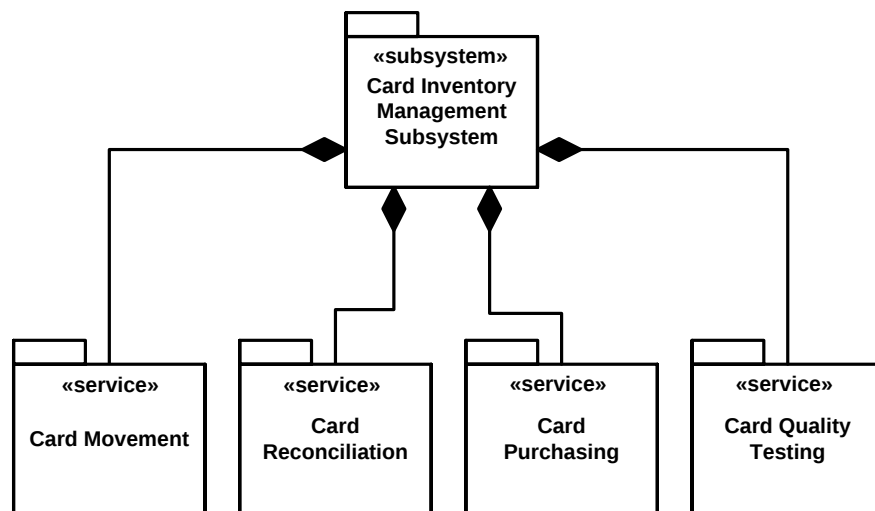
- (8) Device Management Subsystem is responsible for monitor and validate of the service provider's card readers, which have the transactions, and transfer them to the CCH.

Chart 3-14 Overview of Device Management Subsystem



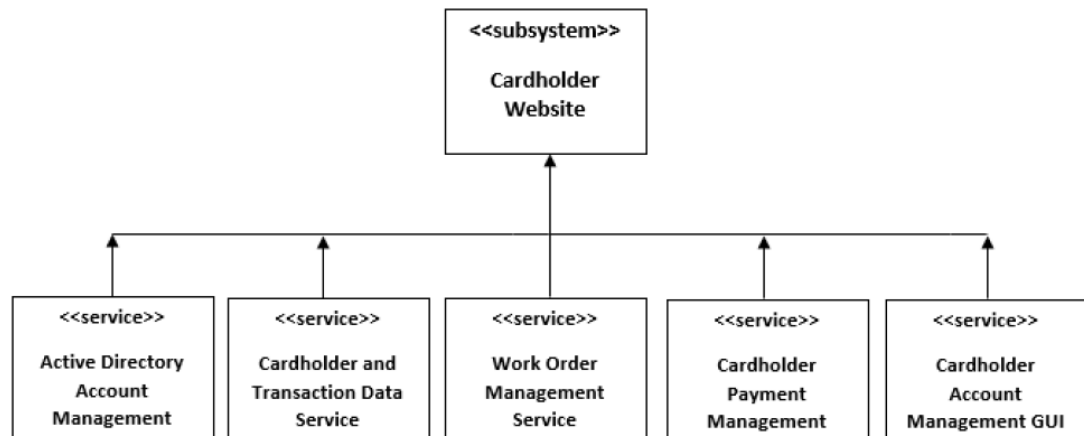
- (9) Card Inventory Subsystem is responsible for card stock management, including supervising card movement and card inventory in each shop.

Chart 3-15 Overview of Card Inventory Subsystem



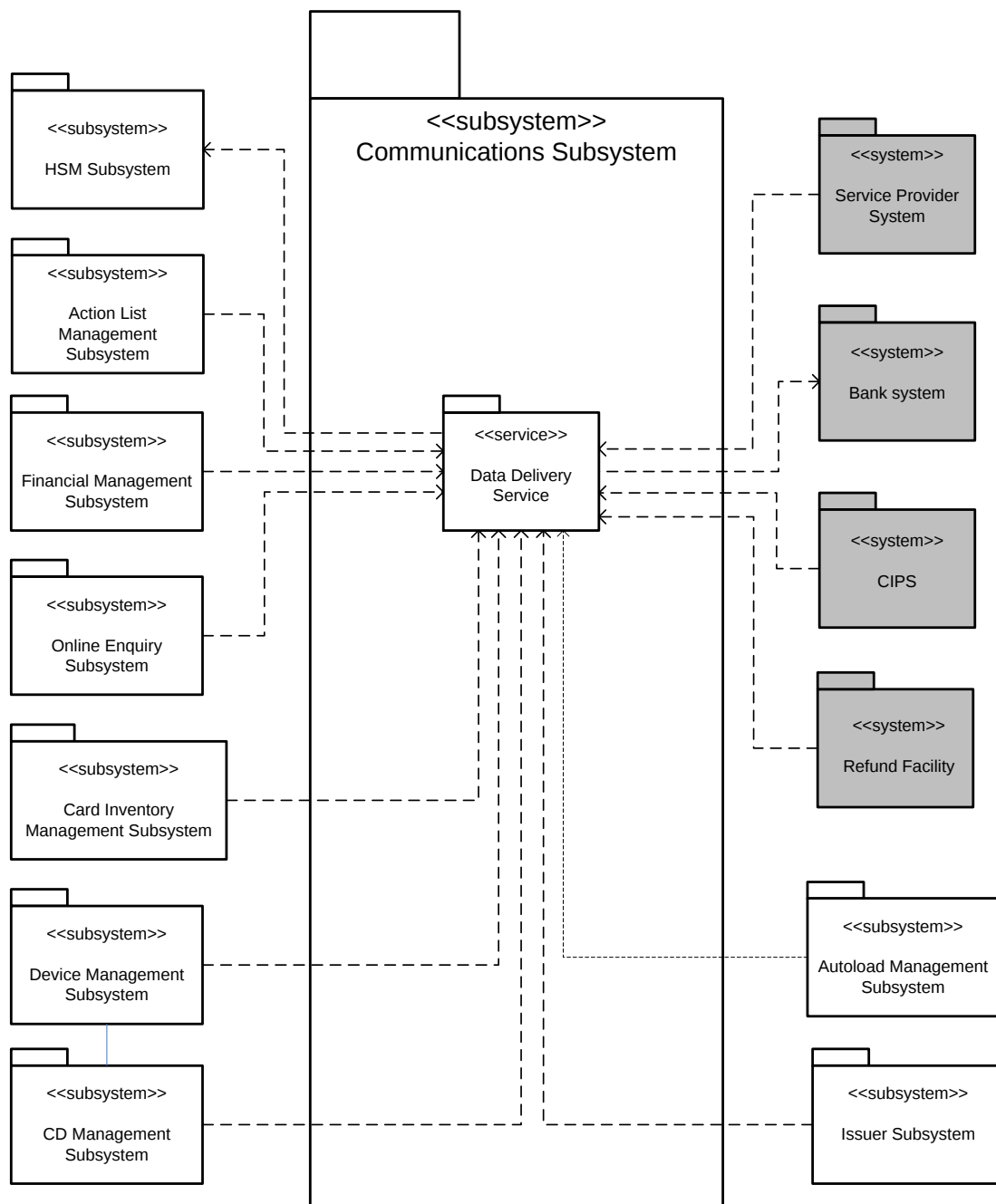
- (10) Cardholder Website Subsystem is responsible for providing services to cardholders such as registration/amendment of card information or personal data, check card usage check and online top-up, etc.

Chart 3-16 Overview of Cardholder Website Subsystem



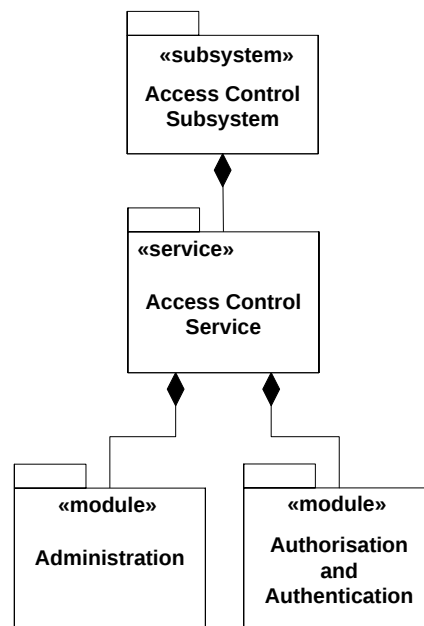
- (11) Communication Management Subsystem is responsible for communication both communicate among the CCH's subsystems, transfer for card usage data (UD) and configuration data (CD), and communicate between the service providers' devices and the CCH, and interface with banks' payment channels in the clearing and settlement process.

Chart 3-17 Overview of Communication Management Subsystem



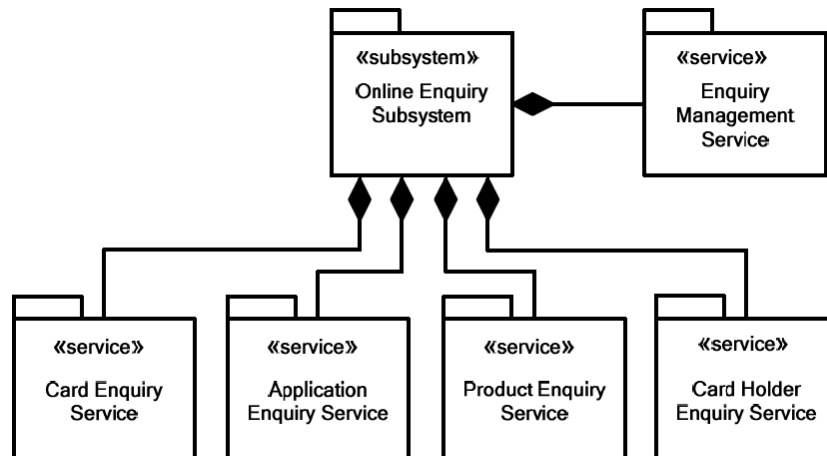
- (12) Access Control Subsystem is responsible for control the accessibility to the CCH's subsystem. The system's administrators will manage the subsystem user accounts, including the usage rights for each command. The users have to identify their user names and passwords before the access. The Access Control Subsystems will check the users' rights if they are permitted to access the screen or use each command.

Chart 3-18 Overview of Access Control Subsystem



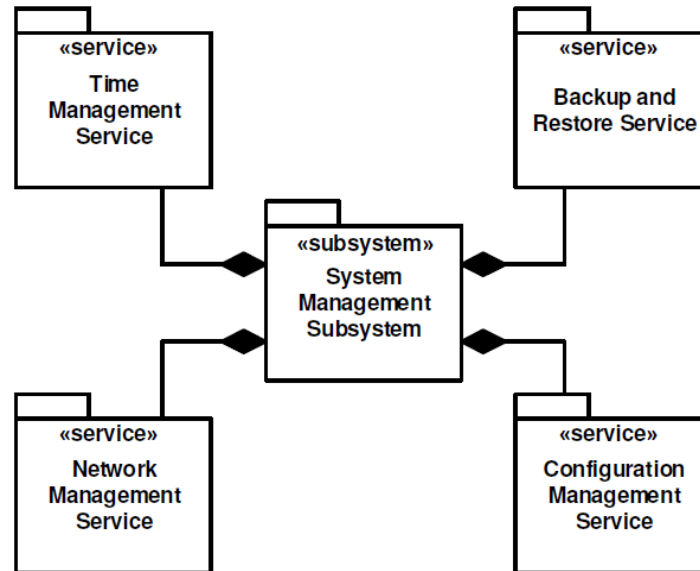
- (13) Online Enquiry Subsystem is responsible for monitoring card usage history and card account movement.

Chart 3-19 Overview of Online Enquiry Subsystem



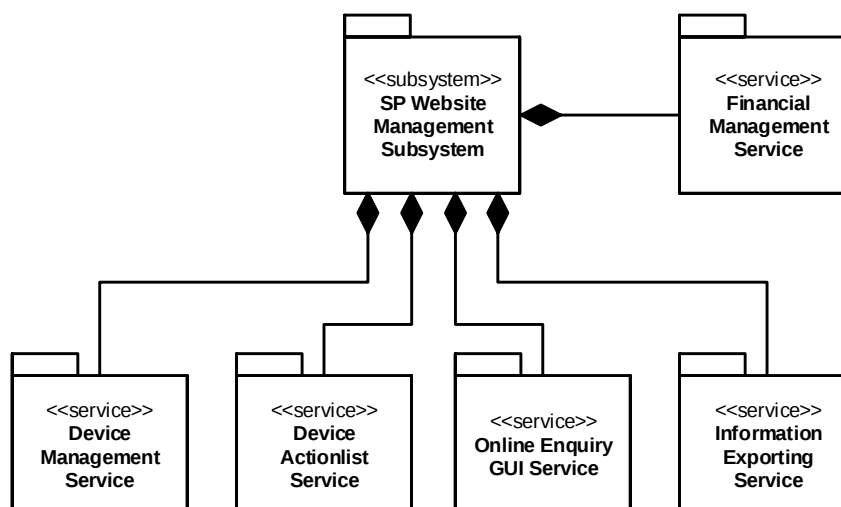
- (14) System Management Subsystem is responsible for checking the CCH's operational status.

Chart 3-20 Overview of System Management Subsystem



- (15) SP Website Subsystem is responsible for providing services to service providers who wish to register and manage the devices, both looks their devices' status data, as well as giving command to suspend their devices including access to view settlement data, card data and cardholder data.

Chart 3-21 Overview of SP Website Subsystem



## Security Architecture

Overall, the common ticket based payment system divides the equipment into;

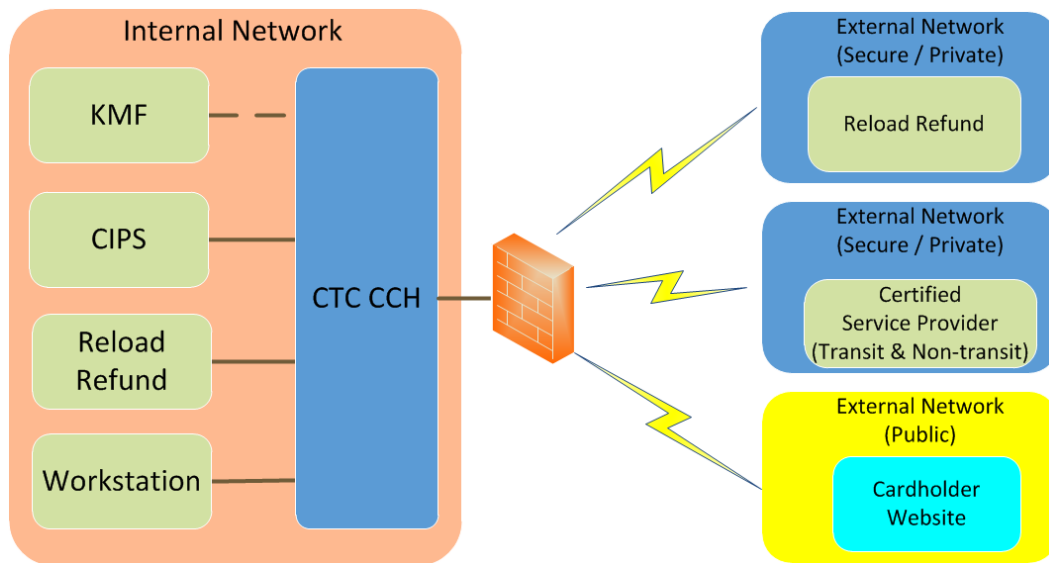
Tier 0 – Card or e-money media

Tier 1- Card reader

Tier 2-3 – Service providers' fare collection system devices depending on individual service provider's system design, and;

Tier 4 – The Central Clearing House's systems

Chart 3-22 Security Architecture



Security determination in common ticketing system can be classified as in Table 2-7.

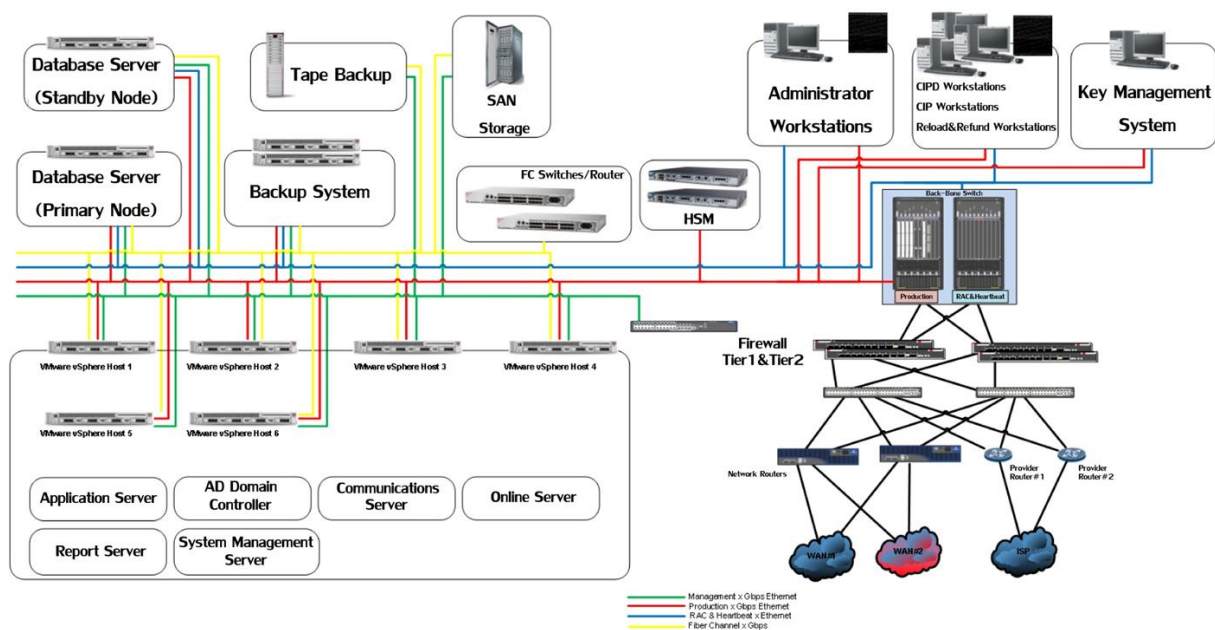
Table 3-5 Details of Each Security Level Application

| Data             | Disclosure Audience | Environments                           | Controls                                                                                        | Security Level | Key(s) |
|------------------|---------------------|----------------------------------------|-------------------------------------------------------------------------------------------------|----------------|--------|
| CD               | SP                  | L4, L3 and Other<br>L3 SP              | Operating System Access Control                                                                 | CD             |        |
| Card Data        | Device              | Public                                 | Encrypted or Physically Secure storage<br>Encrypted transmission from reader to card and return | Card           | Key    |
| Transaction (UD) | L2-L4               | OTP L4 CCH,<br>Other L3 SP             | Secured Communication and MAC                                                                   | Transaction    | Key    |
| Master Card keys | SAM, HSM, KMF       | CIPD, KMF,<br>Distribution SAM,<br>SAM | Encrypted when transferred between<br>SAMS                                                      | Master Key     |        |

| Data                              | Disclosure Audience        | Environments                                          | Controls                                                             | Security Level | Key(s) |
|-----------------------------------|----------------------------|-------------------------------------------------------|----------------------------------------------------------------------|----------------|--------|
| Derived Card Keys                 | Card Reader, Card, KMF     | Device, Card                                          | Only generated when needed on device card reader                     | Derived Key    |        |
| Master Encryption Keys            | SAM, HSM, KMF              | CIPD, KMF, Distribution SAM, SAM                      | Encrypted when transferred between SAMs                              | Master Key     |        |
| MAC keys                          | SAM, HSM, KMF              | SAM, HSM                                              | Physically Secure                                                    | Master Key     | MACK   |
| Derived Encryption Keys           | SAM, HSM, KMF              | SAM, HSM                                              | Derived, Physically secure environment                               | Derived Key    |        |
| SAM Activation/Access             | SAM, HSM, KMF, Application | SAM, HSM, Applications                                | SAM access mechanism                                                 | Master         | CHV    |
| User Passwords                    | User, Login Screen         | User storage, access control storage, computer memory | Access Control, Database encryption                                  | Password       |        |
| System Programs and Configuration |                            |                                                       | Operating System Access Control, Physical Environment Access Control | Application    |        |

## Technical Architecture and Network Design

Chart 3-23 Network Architecture



## 2) Front-End Devices

Front-End devices provided for the Establishment of the Central Clearing House project consist of Card Initialization and Personalization (CIPD), and Reload and Refund Machine.

### Card Initialization and Personalization Device (CIPD)

Card Initialization and Personalization Device allows operators to issue cards and record personal data before sending to the cardholders. The system's functions can be summarized as follows;

- Card Initialisation Service for initialize card. It has two types; manual and bulk initialization.
- Card Re-Initialisation Service for re-initialize card. It has two types; manual and bulk re-initialization.
- Card Personalisation Service for record cardholder's personal data in cards for both Level 1 and Level 2.
- Staff Card Creation for creating common ticketing system's staff cards
- Card Printing for printing cardholder's data on cards using desktop card printer
- Card Issuance and Sale Service for distributing card to customers
- Card Add Value Service for card top-up
- Card Add Value Reverse Service for top-up cancellation
- Card Activation for suspended card activation
- Card Disposal for recording data of cards to be disposed
- Card Online Enquiry for viewing card data in common ticketing system
- Card Enquiry and Analysis Service for viewing card data
- Standard Common Product Issuance for time-limited and trip-limited card issuance
- Standard Common Product Issuance Reversal for time-limited and trip-limited card cancellation
- Shift Management and Reporting Service for operators' shift management

Chart 3-24 Card Initialization and Personalization Device and interface with other Sub-systems

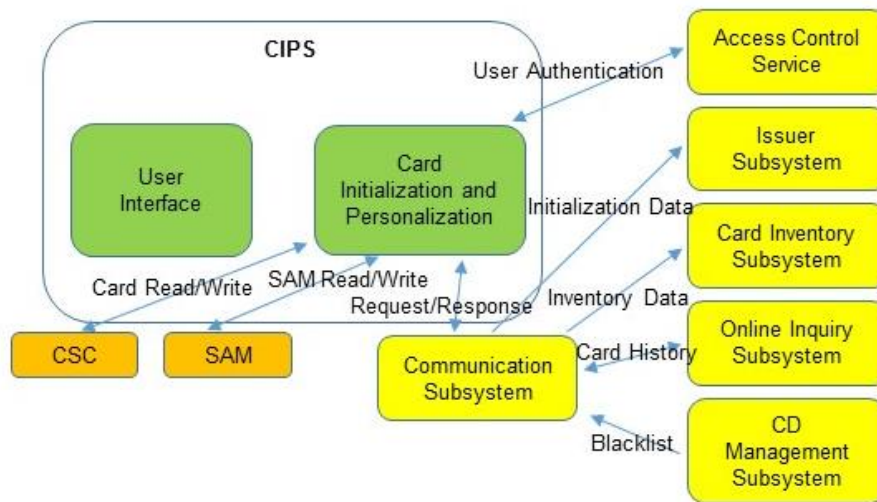


Chart 3-25 Card Initialization and Personalization Devices



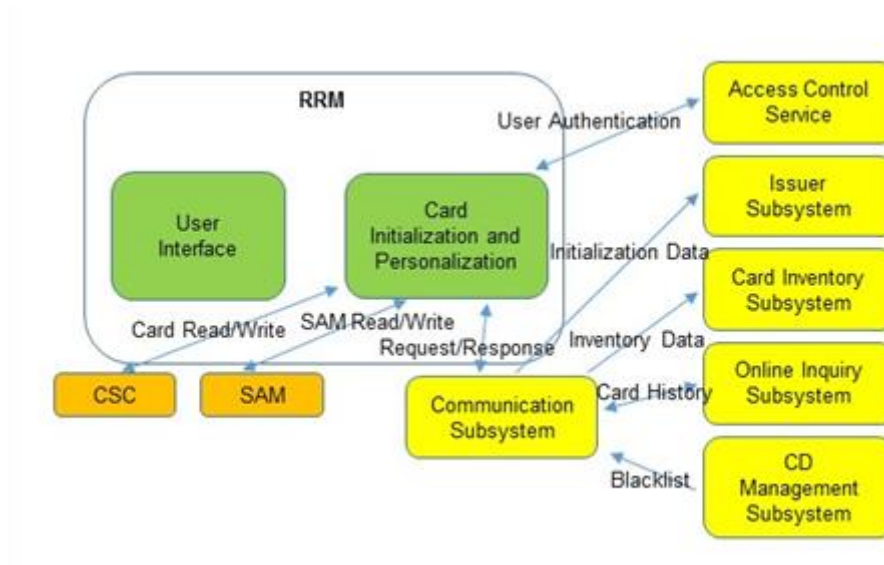
### Reload and Refund Machine

Reload/Refund Machine is used for refund and reload. The system is able to;

- Card Issuance and Sale Service for purchasing card to consumers
- Card Add Value Service for card top-up
- Card Add Value Reverse Service for top-up cancellation
- Card Activation for activate the suspended card
- Auto-Top up for opening/closing/modifying automatic top-up service
- Card Refund for giving refund to cardholders whose cards are readable
- Defer Card Refund for giving refund to cardholders whose cards are damaged or lost
- Card Replacement for changing cards for cardholders whose cards are readable

- Defer Card Replacement for changing cards for cardholders whose cards are damaged or lost
- Card Online Enquiry for viewing card data in common ticketing system
- Card Enquiry and Analysis Service for viewing card data
- Shift Management and Reporting Service for operators' shift management

Chart 3-26 Reload and Refund Machine and interface with other Sub-systems

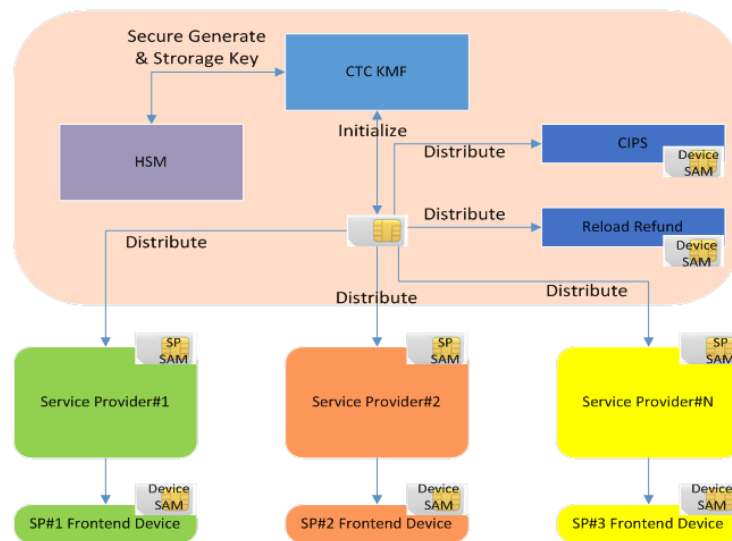


### 3) Common Ticket Security System

#### Key Management System (KMS)

The security monitoring system is Key Management System (KMS), which manages encryption/decryption and issues Certificate Authority in order to identify service providers. The KMS creates Public Key and Private Key to fill in the Secure Access Module (SAM), which will be sent to service providers. The service providers are able to use the Public Key and Private Key stored in the SAM for encrypt and decrypt the data sending to and receiving from the CCH.

Chart 3-27 Overview of Security Management System



### SAM Standards and Details

This section shows guideline for SAM's design which is used in the Establishment of the Central Clearing House project. The SAM's specifications are as follows;

- SAM used in the project is able to work with general card readers that support ISO 7816 standard.
- Support encryption standards and electronic signatures such as DES, AES and RSA
- Able to store keys used for the encryption
- Able to determine methods for adding keys into the SAM or deleting them from the SAM
- Offer procedures for updating keys kept by service providers through key update files

#### 4) Interface with related parties

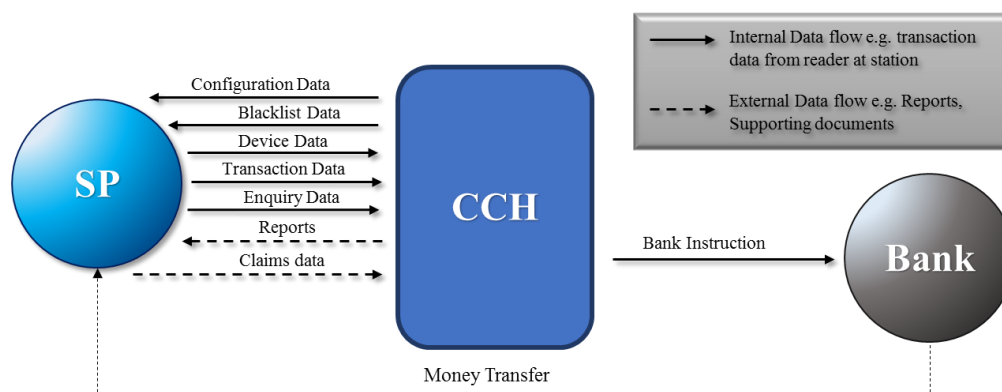
Determination of interface file formats that are used for transfer between the CCH and the third parties, service providers or banks. The Interface File can be classified into;

- (1) Operator Interface File determines usage data file format transfer from service providers to the CCH and configuration data file format transfer to service providers.
- (2) Equipment Initialization Interface File determines data file format, device interface and data transfer methods

Autoload Interface File This connection occurs when a bank provides an automatic top-up service for a client account. The CCH determines the Interface file format which is required to transfer from banks to the CCH such as blacklist, and cancellation/change of services.

Bank Interface File is a command format related to the settlement which is performed according to the NPMS standard of the Bank of Thailand. The transfer between the banks and the CCH is encrypted.

Chart 3-28 Interface with related parties



### 3.3 Inspection of Compliance with Specifications and Design Documents

According to the CCH design as summarized in 3.2, the PMS consulting group reviewed documents and monitored the system to ensure that it is complied with the specifications as stipulated in the Contract. The PMS Consulting Group compared the design details with the technical specifications in the Particular Specification and Business Rules as stated in Appendix 6 in the General Specification (GS) and create the traceability matrix as shown in **Table 3-6** and **Table 3-7**.

Table 3-6Traceability Matrix (Volume 3 Part 3 : Particular Specification: PS)

| Technical Specifications |                                 | Design Documents   |                                                                         |                                                        | Compliance | Note            |
|--------------------------|---------------------------------|--------------------|-------------------------------------------------------------------------|--------------------------------------------------------|------------|-----------------|
| No.                      | Topic                           | Document           | Document                                                                | Topic                                                  |            |                 |
| 1                        | INTRODUCTION                    |                    |                                                                         |                                                        |            | For Information |
| 1.1                      | Introduction                    |                    |                                                                         |                                                        |            | For Information |
| 1.2                      | Definitions                     |                    |                                                                         |                                                        |            | For Information |
| 2                        | SYSTEM FUNCTIONAL OVERVIEW      |                    |                                                                         |                                                        |            | For Information |
| 2.1                      | Overview                        |                    |                                                                         |                                                        |            | For Information |
| 2.2                      | The Disaggregation of Functions | BSVB.00010 Rev.2.0 | Technical and Network Architecture                                      | Clause 2 Technical Architecture Overview               | ✓          |                 |
|                          |                                 | BSW.00001 Rev.2.0  | System Architecture                                                     | Clause 2 System Design                                 |            |                 |
| 2.3                      | Smart Cards                     | BSVB.00001 Rev.3.0 | NC Card Data Definition                                                 | Clause 4 Card File Description                         | ✓          |                 |
|                          |                                 | BSVS.00009 Rev.2.0 | Card Initialization and Personalization Subsystem Design Specifications | Clause 3 Card Initialization Service                   |            |                 |
|                          |                                 |                    |                                                                         | Clause 5 Card Personalization Service                  |            |                 |
|                          |                                 | BSVB.00116 Rev.2.0 | Configuration Data Management Subsystem Software Design Specification   | Clause 5.2 Data Design                                 |            |                 |
|                          |                                 | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                                   | Clause 5.1 Module Design                               |            |                 |
| 2.4                      | Host Systems                    | BSW.00002 Rev.3.0  | System Security Architecture                                            | Clause 2 System Design                                 | ✓          |                 |
|                          |                                 | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification                     | Clause 5.1.6 Claims Management Service Detailed Design |            |                 |
| 2.5                      | The CCH System                  |                    |                                                                         |                                                        |            | For Information |

| Technical Specifications |                                                  | Design Documents   |                                                     |                                                          | Compliance | Note            |
|--------------------------|--------------------------------------------------|--------------------|-----------------------------------------------------|----------------------------------------------------------|------------|-----------------|
| No.                      | Topic                                            | Document           | Document                                            | Topic                                                    |            |                 |
| 2.5.1                    | Overview                                         |                    |                                                     |                                                          |            | For Information |
| 2.5.1 (A)                | Clearing/Settlement system                       | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification | Clause 5.1.1.1.1 Transaction validation                  | ✓          |                 |
|                          |                                                  | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification               | Clause 5.1 Module Design                                 |            |                 |
| 2.5.1 (B)                | Card system                                      | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification               | Clause 5.1.13 Card State TP Sub-Module Design            | ✓          |                 |
| 2.5.1 (C)                | Infrastructure Operating Management System       | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 5.1 Design Module                                 | ✓          |                 |
| 2.5.1 (D)                | Back End System                                  | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 2.2 Data Decomposition                            | ✓          |                 |
| 2.5.1 (E)                | System of Common Ticketing                       | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 2.2 Data Decomposition                            | ✓          |                 |
| 2.5.2                    | CCH main Functionalities                         |                    |                                                     |                                                          |            | For Information |
| 2.5.2 (A)                | System and Functional description                |                    |                                                     |                                                          |            | For Information |
| a)                       | Clearing/Settlement system                       | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification | Clause 5.1.1 Clearing Validation Service Detailed Design | ✓          |                 |
| b)                       | Card system                                      |                    |                                                     |                                                          |            | For Information |
| c)                       | Infrastructure Operating Management System(IOMS) | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 2.2 Data Decomposition                            | ✓          |                 |
|                          |                                                  | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification    | Clause 4.1.1.1 Device Registry Maintenance Module Design |            |                 |

| Technical Specifications |                                                              | Design Documents   |                                                       |                                                          | Compliance | Note |
|--------------------------|--------------------------------------------------------------|--------------------|-------------------------------------------------------|----------------------------------------------------------|------------|------|
| No.                      | Topic                                                        | Document           | Document                                              | Topic                                                    |            |      |
|                          |                                                              | BSVB.00047 Rev.2.0 | System Management Subsystem Design Specification      | Clause 5 Network Management Service                      |            |      |
| d)                       | Interface system                                             | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 2.2 Data Decomposition                            | ✓          |      |
| 2.5.3                    | Scheme Authority (CTO) Interface                             | BSVB.00046 Rev.2.0 | Report Management Software Design Specification       | Clause 2.1 Module Decomposition                          | ✓          |      |
| 2.5.4                    | Regulatory Environment                                       | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification   | Clause 5 Design                                          | ✓          |      |
| 2.5.5                    | CCH List of Primary Functions<br>The Common Ticketing System | BSVB.00040 Rev.2.0 | Action List Management Subsystem Design Specification | Clause 5.1.3 Actionlist Administration Service           | ✓          |      |
|                          |                                                              | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 5.2.8 Blacklist Information                       |            |      |
|                          |                                                              | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 5.1 Module Design                                 |            |      |
|                          |                                                              | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification   | Clause 4.1.1.1 Device Registry Maintenance Module Design |            |      |
|                          |                                                              | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification   | Clause 3.1 Financial Management Subsystem                |            |      |
|                          |                                                              | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                 | Clause 5.1 Dependencies Module Design                    |            |      |
|                          |                                                              |                    |                                                       | Clause 2.1.1 Issuer Subsystem Decomposition              |            |      |
|                          |                                                              |                    |                                                       | Clause 4.1.3 Actionlist Management Subsystem             |            |      |
|                          |                                                              |                    |                                                       | Clause 5.1 Module Design                                 |            |      |
|                          |                                                              |                    |                                                       | Clause 5.2.1 Card Account Design                         |            |      |

| Technical Specifications |                                                                                                                                                          | Design Documents    |                                                        |                                                                | Compliance | Note            |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------|----------------------------------------------------------------|------------|-----------------|
| No.                      | Topic                                                                                                                                                    | Document            | Document                                               | Topic                                                          |            |                 |
|                          |                                                                                                                                                          | BSW.00011 Rev.2.0   | Cardholder Website Software Design Specification       | Clause 2.1.2 Active Directory Account Management Decomposition |            |                 |
| 2.6                      | Technical Requirements                                                                                                                                   | BSVB.00010 Rev.2.0  | Technical and Network Architecture                     | Clause 2.1 System Capacity                                     | ✓          |                 |
| 2.7                      | Business Requirements                                                                                                                                    |                     |                                                        |                                                                |            | For Information |
| 2.8                      | Security Requirements                                                                                                                                    | BSVS.00039 Rev.2.0  | Access Control Design Specification                    | Clause 5.1.1 Administration Module                             | ✓          |                 |
|                          |                                                                                                                                                          | BSW.00002 Rev.3.0   | System Security Architecture                           | Clause 2 System Design                                         | ✓          |                 |
| 2.9                      | Regulatory Compliance                                                                                                                                    | BSVS.00010 Rev.2.0  | Key Management Subsystem Software Design Specification | Clause 2 CCH Key Management Scheme                             | ✓          |                 |
| 2.10                     | System Topology and Capacities                                                                                                                           | BSVB.00010 Rev.2.0  | Technical and Network Architecture                     | Appendix B Data Storage Calculation                            |            |                 |
|                          |                                                                                                                                                          | BSW.00010 Rev.2.0   | Issuer Subsystem Design Specification                  | Clause 5.1 Module Design                                       | ✓          |                 |
| 2.11                     | Equipment quantities                                                                                                                                     | BSVS.00001 Rev.1.0  | Hardware Bill of Materials                             | Clause 5.2.1 Card Account Design                               |            |                 |
| 3                        | SCOPE OF SUPPLY                                                                                                                                          |                     |                                                        | Hardware Bill of Materials                                     | ✓          |                 |
| 3.1                      | Central Clearing House System. The contractor shall design, supply, deliver, install and test a Central Clearing House System as described in Chapter 4. | BSVB.00043 Rev.2.0  | Communication Subsystem Design Specification           | Clause 5.1 Design Module                                       |            |                 |
|                          |                                                                                                                                                          | BSVB.00010 Rev.2.0  | Technical and Network Architecture                     | Clause 5 Disaster Recovery Management<br>Clause 6 System Nodes | ✓          |                 |
| 3.2                      | Contactless Smart Cards and Data Layout                                                                                                                  | BSVB.00001 Rev.3.0  | NC Card Data Definition                                | Clause 2 Card General Description                              | ✓          |                 |
| 3.3                      | Data Centre and Office Space                                                                                                                             | BSVB.00048 Rev. 2.0 | Central Clearing House Network Design                  | -                                                              | ✓          |                 |
| 3.4                      | Project Scope                                                                                                                                            | BSVB.00010 Rev.2.0  | Technical and Network Architecture                     | Clause 5 Disaster Recovery Management                          | ✓          |                 |

| Technical Specifications |                                                      | Design Documents   |                                                     |                                                                                                                | Compliance | Note |
|--------------------------|------------------------------------------------------|--------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                | Document           | Topic                                               |                                                                                                                |            |      |
| 4                        | PARTICULAR SPECIFICATIONS OF CCH SYSTEM              |                    |                                                     |                                                                                                                |            |      |
| 4.1                      | Clearing/Settlement System                           | BSVB.00046 Rev.2.0 | Report Management Software Design Specification     | Clause 5.1 Functional Requirements                                                                             | ✓          |      |
| 4.1.1                    | Objective                                            |                    |                                                     |                                                                                                                |            |      |
| 4.1.2                    | Clearing/Settlement Functionality (CSF)              | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 5.1.2 FTP Module                                                                                        | ✓          |      |
|                          |                                                      | BSVB.00046 Rev.2.0 | Report Management Software Design Specification     | Clause 5.1.5 SFTP Module                                                                                       |            |      |
|                          |                                                      | BSVV.00009 Rev.2.0 | Financial Management Subsystem Design Specification | Clause 5.1 Functional Requirements                                                                             |            |      |
|                          |                                                      | BSVV.00010 Rev.2.0 | Issuer Subsystem Design Specification               | Clause 3.1 Financial Management Subsystem<br>Clause 5.1 Dependencies Module Design<br>Clause 5.1 Module Design |            |      |
| 4.1.3                    | Financial Functionality (FF)                         | BSVB.00046 Rev.2.0 | Report Management Software Design Specification     | Clause 5.1.5 Financial Reports                                                                                 | ✓          |      |
|                          |                                                      | BSVV.00009 Rev.2.0 | Financial Management Subsystem Design Specification | Clause 5.1 Module Design                                                                                       | ✓          |      |
|                          |                                                      | BSVV.00010 Rev.2.0 | Issuer Subsystem Design Specification               | Clause 5.1 Module Design                                                                                       |            |      |
| 4.1.4                    | Settlement Management Operation Functionality (SMOF) | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification        | Clause 5.1.2.5 FTP CD Collaborations                                                                           | ✓          |      |
|                          |                                                      | BSVB.00046 Rev.2.0 | Report Management Software Design Specification     | Clause 5.1.5 Configuration Data Reports                                                                        |            |      |

| Technical Specifications |                                                      | Design Documents   |                                                         |                                                                       | Compliance | Note |
|--------------------------|------------------------------------------------------|--------------------|---------------------------------------------------------|-----------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                | Document           | Document                                                | Topic                                                                 |            |      |
| 4.1.5                    | Settlement Report Service Functionality (SRSF)       | BSVB.00046 Rev.2.0 | Report Management Software Design Specification         | Clause 2.1 Module Decomposition<br>Clause 5.1 Functional Requirements | ✓          |      |
| 4.2                      | Card System                                          | BSVB.00045         | Hosy Security Management Subsystem Design Specification | Clause 2.2.1 UD Verification Service Decomposition                    | ✓          |      |
|                          |                                                      | BSV.00009 Rev.2.0  | Financial Management Subsystem Design Specification     | Clause 2.1.1.2 Clearing Validation Service                            |            |      |
|                          |                                                      |                    |                                                         | Clause 3.1 Financial Management Subsystem Dwpendencies                |            |      |
|                          |                                                      | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                   | Clause 5.1 Module Design                                              |            |      |
| 4.2.1                    | Objective                                            | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification            | Clause 5.1.2 FTP Module                                               | ✓          |      |
| 4.2.2                    | Card Issuance System (CIS)                           |                    |                                                         |                                                                       |            |      |
| 4.2.2 (A)                | Functional Requirements                              | BSVS.00039 Rev.2.0 | Access Control Design Specification                     | Clause 4.1.1 Authentication and Authorization Interface               | ✓          |      |
|                          |                                                      | BSVB.00040 Rev.2.0 | Action List Management Subsystem Design Specification   | Clause 2.1 Action list Management Subsystem Decomposition             |            |      |
| 4.2.2 (B)                | Key Management System (KMS)                          | BSVS.00010 Rev.2.0 | Key Management Subsystem Software Design Specification  | Clause 2 CCH Key Management Scheme                                    | ✓          |      |
| 4.2.2 (C)                | Card Application Management Functionality (CAMF)     | BSVS.00010 Rev.2.0 | Key Management Subsystem Software Design Specification  | Clause 2 CCH Key Management Scheme                                    | ✓          |      |
| 4.2.2 (D)                | Card Authentication Management Functionality (CAUMF) | BSVB.00045 Rev.1.0 | Hosy Security Management Subsystem Design Specification | Clause 9.1.2 Storing Application Key With Software                    | ✓          |      |

| Technical Specifications |                                                      | Design Documents   |                                                                         |                                                                                                  | Compliance | Note |
|--------------------------|------------------------------------------------------|--------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                | Document           | Document                                                                | Topic                                                                                            |            |      |
| 4.2.2 (E)                | Common Card Personalization Management System (CPMS) | BSVS.00009 Rev.2.0 | Card Initialization and Personalization Subsystem Design Specifications | Clause 2.2 Product Functions                                                                     | ✓          |      |
| 4.2.3                    | Card Management System (CMS)                         |                    |                                                                         |                                                                                                  |            |      |
| 4.2.3 (A)                | Functional Requirement                               | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                                   | Clause 5.1 Module Design<br>Clause 5.2.1 Card Account Design                                     | ✓          |      |
| 4.2.3 (B)                | Reload & Refund Management Functionality (RRMF)      | BSVB.00041 Rev.2.0 | Autoload Management Subsystem Design Specification                      | Clause 5.1.1 Autoload Authorization Service<br>Clause 5.1.5 Autoload for Low Income Card         | ✓          |      |
|                          |                                                      | BSVB.00046 Rev.2.0 | Report Management Software Design Specification                         | Clause 5.1.1 Financial Reports<br>Clause 5.1.3 Sales Reports                                     |            |      |
|                          |                                                      | BSVS.00084 Rev.2.0 | Refund and Reload Machine Software Design Specifications                | Clause 6 Card Add Value Service<br>Clause 9 Auto-Top up Activation / Change of Service / Disable |            |      |
|                          |                                                      | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification                     | Clause 5.1.4 Settlement Management<br>Service Detailed Design                                    |            |      |
|                          |                                                      | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                                   | Clause 5.1 Module Design                                                                         |            |      |
|                          |                                                      | BSW.00014          | Online Enquiry Subsystem Design Specification                           | Clause 5.1.1 Card Enquiry Service<br>Clause 5.1.3 Product Enquiry Service                        |            |      |
| 4.2.3 (C)                | Card Purchasing Functionality                        | BSW.00010 Rev.2.0  | Issuer Subsystem Design Specification                                   | Clause 5.1 Module Design                                                                         | ✓          |      |
| (a)                      | Offline purchase service requirements                | BSVS.00084 Rev.2.0 | Refund and Reload Machine Software Design Specifications                | Clause 5 Card Issuance and Sale Service                                                          | ✓          |      |

| Technical Specifications |                                                       | Design Documents    |                                                                       |                                                                                                   | Compliance | Note |
|--------------------------|-------------------------------------------------------|---------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                 | Document            | Document                                                              | Topic                                                                                             |            |      |
| (b)                      | Online Purchase Service Requirements                  | BSVS.00084 Rev.2.0  | Refund and Reload Machine Software Design Specifications              | Clause 5 Card Issuance and Sale Service                                                           | ✓          |      |
| (c)                      | Buying Service requirements                           | BSVB.00046 Rev.2.0  | Report Management Software Design Specification                       | Clause 5.1.3 Sales Reports                                                                        | ✓          |      |
|                          |                                                       | BSW.00010 Rev.2.0   | Issuer Subsystem Design Specification                                 | Clause 5.1 Module Design                                                                          |            |      |
| 4.2.4                    | Common Ticket Ledger Management Functionality (CTLMF) | BSVB.00046 Rev.2.0  | Report Management Software Design Specification                       | Clause 5.1.4 Exception Reports                                                                    | ✓          |      |
|                          |                                                       | BSW.00010 Rev.2.0   | Issuer Subsystem Design Specification                                 | Clause 5.1 Module Design                                                                          | ✓          |      |
| 4.2.5                    | Merchant Information Management Functionality (MIMF)  | BSVB.00116 Rev.2.0  | Configuration Data Management Subsystem Software Design Specification | Clause 2.2.3 SP CD Decomposition                                                                  | ✓          |      |
| 4.2.6                    | Card Report Service Functionality (CRSF)              | BSVB.00042 Rev. 1.0 | Card Inventory Management                                             | Clause 5.1 Module Design                                                                          | ✓          |      |
| 4.3                      | Infrastructure Operating Management System (IOMS)     |                     |                                                                       |                                                                                                   |            |      |
| 4.3.1                    | Objective                                             | BSVB.00040 Rev.2.0  | Action List Management Subsystem Design Specification                 | Clause 4.2 Communication Subsystem                                                                | ✓          |      |
|                          |                                                       | BSVB.00043 Rev.2.0  | Communication Subsystem Design Specification                          | Clause 5.1.2.5 FTP CD Collaborations<br>Clause 5.1.5.2 Settlement Instruction File Collaborations |            |      |
|                          |                                                       |                     |                                                                       | Clause 5.1.7.2 System Usage Data Collaboration                                                    |            |      |

| Technical Specifications |                                                                                                 | Design Documents   |                                                  |                                                          | Compliance | Note |
|--------------------------|-------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------|----------------------------------------------------------|------------|------|
| No.                      | Topic                                                                                           | Document           | Document                                         | Topic                                                    |            |      |
|                          |                                                                                                 | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification     | Clause 2.2 Data Decomposition                            |            |      |
|                          |                                                                                                 | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification | Clause 2.1.4 Device Management GUI Service Decomposition |            |      |
|                          |                                                                                                 | BSVB.00047 Rev.2.0 | System Management Subsystem Design Specification | Clause 5 Network Management Service                      |            |      |
| 4.3.2                    | SP Interface Management Functionality (SIMF)                                                    |                    |                                                  |                                                          |            |      |
| 4.3.2 (A)                | Sending/receiving Information for SP types                                                      | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification     | Clause 4.1.1 HSM Subsystem                               | ✓          |      |
| 4.3.2 (B)                | Equipment Management Functionality (EMF)                                                        | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification     | Clause 5.1.5 SFTP Module                                 | ✓          |      |
|                          |                                                                                                 | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification | Clause 4.1.1.1 Device Registry Maintenance Module Design |            |      |
| 4.3.2 (C)                | Operation Information Management Functionality (OIMF)                                           | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification     | Clause 5.1.2.5 FTP CD Collaborations                     | ✓          |      |
|                          |                                                                                                 | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification | Clause 2.1.3 Status Management Service Decomposition     |            |      |
| 4.3.2 (D)                | Sending Operational Information to reader device<br>Downloading information to Front End device | BSVB.00011 Rev.2.0 | Configuration Parameters                         | Clause 15 AFC Equipment Configuration Data Table         | ✓          |      |

| Technical Specifications |                                         | Design Documents                         |                                                                                         |                                                                                                                                         | Compliance | Note |
|--------------------------|-----------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                   | Document                                 | Document                                                                                | Topic                                                                                                                                   |            |      |
| 4.3.2 (E)                | Portal Web Service Functionality (PWSF) | BSW.00005 Rev.2.0                        | Cardholder Software Requirement Specification                                           | Clause 2.1.2 Active Directory Account Management Decomposition<br>Clause 2.1.3 Cardholder and Transaction History Service Decomposition | ✓          |      |
| 4.3.2 (F)                | Data Transmission Functionality (DTF)   | BSVB.00043 Rev.2.0                       | Communication Subsystem Design Specification                                            | Clause 5.1.2 FTP Module<br>Clause 5.1.5 SFTP Module                                                                                     | ✓          |      |
| 4.3.2 (G)                | Administration Management Functionality | BSVS.00039 Rev.2.0<br>BSVB.00047 Rev.2.0 | Access Control Design Specification<br>System Management Subsystem Design Specification | Clause 5.3 Non Functional Design<br>Clause 5 Network Management Service                                                                 | ✓          |      |
| 4.4                      | Interface System                        | BSVB.00042 Rev.1.0<br>BSVB.00043 Rev.2.0 | Card Inventory Management<br>Communication Subsystem Design Specification               | Clause 5.1 Module Design<br>Clause 5.1.2 FTP Module                                                                                     | ✓          |      |
| 4.5                      | Call Centre Function                    |                                          |                                                                                         |                                                                                                                                         |            |      |
| 4.5.1                    | Functional Requirements                 | BSW.00010 Rev.2.0                        | Issuer Subsystem Design Specification                                                   | Clause 5.1 Module Design                                                                                                                | ✓          |      |
| 4.5.2                    | Facility Requirements                   | Note                                     | Facility provide by CTC                                                                 |                                                                                                                                         | ✓          |      |
| 4.6                      | System Design Principle and Standard    | BSW.00001 Rev.2.0                        | System Architecture                                                                     | Clause 2 System Design                                                                                                                  | ✓          |      |
| 4.6.1                    | Open-Based Architecture                 | BSW.00001 Rev.2.0                        | System Architecture                                                                     | Clause 2.3 Software Design                                                                                                              | ✓          |      |
| 4.6.2                    | Flexibility and Scalability             | BSVB.00101 Rev.1.0                       | Configuration Data Management<br>Subsystem Software Requirement Specification           | Clause 5.2.2 CD Entity                                                                                                                  | ✓          |      |
| 4.6.3                    | Reliability, Maintenance                | BSW.00001 Rev.2.0                        | System Architecture                                                                     | Clause 2.3 Software Design                                                                                                              | ✓          |      |
| 4.6.4                    | Maximizing availability                 | BSW.00001 Rev.2.0                        | System Architecture                                                                     | Clause 2.3 Software Design                                                                                                              | ✓          |      |

| Technical Specifications |                                                      | Design Documents    |                                                         |                                                          | Compliance | Note |
|--------------------------|------------------------------------------------------|---------------------|---------------------------------------------------------|----------------------------------------------------------|------------|------|
| No.                      | Topic                                                | Document            | Document                                                | Topic                                                    |            |      |
| 4.6.5                    | Secured and protected data                           | BSVB.00043 Rev.2.0  | Communication Subsystem Design Specification            | Clause 5.1.2 FTP Module                                  | ✓          |      |
|                          |                                                      | BSVB.00045 Rev. 1.0 | Hosy Security Management Subsystem Design Specification | Clause 5.1.5 SFTP Module                                 |            |      |
|                          |                                                      |                     |                                                         | Clause 2.2.1 UD Verification Service Decomposition       |            |      |
|                          |                                                      | BSVB.00010 Rev.2.0  | Technical and Network Architecture                      | Clause 5 Disaster Recovery Management                    |            |      |
| 5                        | INTERFACE BETWEEN CCH AND PARTICIPANTS               |                     |                                                         |                                                          |            |      |
| 5.1                      | Overview                                             |                     |                                                         |                                                          |            |      |
| 5.1.1                    | Purpose of this Chapter                              |                     |                                                         |                                                          |            |      |
| 5.1.2                    | Scope                                                | BSVS.00039 Rev.2.0  | Access Control Design Specification                     | Clause 4.1.2 Administration Interface                    | ✓          |      |
| 5.2                      | AFC Equipment Configuration Data                     |                     |                                                         |                                                          | ✓          |      |
| 5.2.1                    | Process Overview                                     | BSVB.00040 Rev.2.0  | Action List Management Subsystem Design Specification   | Clause 5 Design                                          | ✓          |      |
|                          |                                                      | BSVB.00044 Rev.2.0  | Device Management Subsystem Design Specification        | Clause 4.1.1.1 Device Registry Maintenance Module Design |            |      |
| 5.3                      | Particular Requirements of the Configuration Process |                     |                                                         |                                                          |            |      |
| 5.3.1                    | Scope of work                                        | BSVB.00011 Rev.2.0  | Configuration Parameter                                 | Clause 4 Service Provider Table                          | ✓          |      |
| 5.3.2                    | Efficiency                                           | BSVB.00011 Rev.2.0  | Configuration Parameter                                 | Clause 2 Parameter Data Structure                        | ✓          |      |

| Technical Specifications |                                                                                                                               | Design Documents   |                                                       |                                                                            | Compliance | Note |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------|----------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                                                                                         | Document           | Document                                              | Topic                                                                      |            |      |
| 5.3.3                    | Implementation Date-time. Each set of Configuration Data shall include an implementation date-time, which may be "IMMEDIATE". | BSVB.00011 Rev.2.0 | Configuration Parameters                              | Clause 2 Parameter Data Structure                                          | ✓          |      |
| 5.3.4                    | Integrity                                                                                                                     | BSVB.00011 Rev.2.0 | Configuration Parameter                               | Clause 2.3 General Parameter File Format                                   | ✓          |      |
| 5.3.5                    | Handshake                                                                                                                     | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 5.1.3 CD Exporter Module                                            | ✓          |      |
| 5.3.6                    | Content of Configuration Data                                                                                                 | BSVB.00040 Rev.2.0 | Action List Management Subsystem Design Specification | Clause 2.2.4.1 Active Blacklist                                            | ✓          |      |
|                          |                                                                                                                               | BSVB.00011 Rev.2.0 | Configuration Parameters                              | Clause 5.2.1 Blacklist                                                     |            |      |
|                          |                                                                                                                               |                    |                                                       | All Submission contents                                                    |            |      |
| 5.4                      | Usage Data (UD)                                                                                                               | BSV.00006 Rev.2.0  | OTP CCH to Operator Interface Specification           | Clause 3 Interface Specification                                           | ✓          |      |
|                          |                                                                                                                               | BSVB.00012 Rev.2.0 | Transaction Data Definition                           | All Submission contents                                                    |            |      |
| 5.4.1                    | Overview                                                                                                                      |                    |                                                       |                                                                            |            |      |
| 5.4.2                    | Transaction Data (TD) from Other Systems                                                                                      | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 5.1.3CD Exporter                                                    | ✓          |      |
|                          |                                                                                                                               | BSVB.00012 Rev.2.0 | Transaction Data Definition                           | Clause 4 Transaction Message Header and Transaction Information Definition |            |      |
| 5.4.3                    | Device Going Into Service                                                                                                     | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 4.1.1.1 Device Registry Maintenance Module Design                   | ✓          |      |
| 5.4.4                    | Device Going Out of Service                                                                                                   | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 2.1.3 Status Management Service Decomposition                       | ✓          |      |

| Technical Specifications |                                                                                                                 | Design Documents   |                                                     |                                                                                                                     | Compliance | Note |
|--------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                                                                                           | Document           | Document                                            | Topic                                                                                                               |            |      |
| 5.4.5                    | National Card Transaction Data<br>The following table identifies the National Card Transaction Data.<br>(Table) | BSVB.00012 Rev.2.0 | Transaction Data Definition                         | Clause 4 Transaction Message Header and Transaction Information Definition                                          | ✓          |      |
| 5.5                      | Daily Financial Process                                                                                         |                    |                                                     |                                                                                                                     |            |      |
| 5.5.1                    | Daily Financial Position                                                                                        | BSVB.00025 Rev.1.0 | OTP CCH to Bank Interface Specification             | Clause 2 CCH Bank Interface Requirements                                                                            | ✓          |      |
|                          |                                                                                                                 | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification | Clause 5.1.4 Settlement Management Service Detailed Design<br>Clause 5.1.9 Payment Events Management Service Design |            |      |
| 5.5.2                    | Approval of Financial Position                                                                                  | BSVB.00025 Rev.1.0 | OTP CCH to Bank Interface Specification             | Clause 2 CCH Bank Interface Requirements                                                                            | ✓          |      |
|                          |                                                                                                                 | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification | Clause 5.1.4 Settlement Management Service Detailed Design<br>Clause 5.1.9 Payment Events Management Service Design |            |      |
| 5.5.3                    | Claim                                                                                                           | BSVB.00025 Rev.1.0 | OTP CCH to Bank Interface Specification             | Clause 2 CCH Bank Interface Requirements                                                                            | ✓          |      |
|                          |                                                                                                                 | BSW.00009 Rev.2.0  | Financial Management Subsystem Design Specification | Clause 5.1.6 Claims Management Service Detailed Design<br>Clause 5.1.9 Payment Events Management Service Design     |            |      |
| 5.6                      | SAM Management                                                                                                  |                    |                                                     |                                                                                                                     |            |      |

| Technical Specifications |                                           | Design Documents   |                                                       |                                                          | Compliance | Note |
|--------------------------|-------------------------------------------|--------------------|-------------------------------------------------------|----------------------------------------------------------|------------|------|
| No.                      | Topic                                     | Document           | Document                                              | Topic                                                    |            |      |
| 5.6.1                    | New SAM Request                           | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 2.1.4 Device Management GUI Service Decomposition | ✓          |      |
| 5.6.2                    | Kill SAM Request                          | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 2.1.4 Device Management GUI Service Decomposition | ✓          |      |
| 5.6.3                    | New Equipment Type Registration           | BSVB.00044 Rev.2.0 | Device Management Subsystem Design Specification      | Clause 2.1.4 Device Management GUI Service Decomposition | ✓          |      |
| 5.7                      | Transmission Characteristics              | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 5.1 Module Design                                 | ✓          |      |
| 5.8                      | System Maintenance                        |                    |                                                       |                                                          |            |      |
| 5.9                      | Messaging                                 | BSVB.00040 Rev.2.0 | Action List Management Subsystem Design Specification | Clause 5.2.3 Card Block Reason                           | ✓          |      |
| 5.10                     | Support of Smart Card Processes           |                    |                                                       |                                                          |            |      |
| 5.10.1                   | Communications Protocol                   | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          |                                                          | ✓          |      |
| 5.10.2                   | Query - Response List                     | BSVB.00046 Rev.2.0 | Report Management Software Design Specification       | Clause 5.1.4 Exception Reports                           | ✓          |      |
| 5.11                     | Message Formatting and Privacy Protection | BSW.00016 Rev.1.0  | Online Enquiry Subsystem Design Specification         | Clause 2.1 Online Enquiry Subsystem                      | ✓          |      |
|                          |                                           |                    |                                                       | Clause 4.1 Online Enquiry Subsystem Interface            |            |      |
|                          |                                           |                    |                                                       | Clause 5.1 Online Enquiry Subsystem Design               |            |      |
| 5.11                     | Message Formatting and Privacy Protection | BSVB.00043 Rev.2.0 | Communication Subsystem Design Specification          | Clause 5.1 Module Design                                 | ✓          |      |

| Technical Specifications |                                          | Design Documents    |                                                         |                                                                           | Compliance | Note |
|--------------------------|------------------------------------------|---------------------|---------------------------------------------------------|---------------------------------------------------------------------------|------------|------|
| No.                      | Topic                                    | Document            | Topic                                                   |                                                                           |            |      |
|                          |                                          | BSVB.00045 Rev.1.0  | Hosy Security Management Subsystem Design Specification | Clause 2.2.1 UD Verification Service Decomposition                        |            |      |
| 6                        | SMART CARD REQUIREMENTS                  |                     |                                                         |                                                                           |            |      |
| 6.1                      | Scope and Purpose                        |                     |                                                         |                                                                           |            |      |
| 6.1.1                    | Scope                                    | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 4 Card File Description                                            | ✓          |      |
| 6.1.2                    | Important Notes                          | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 4 Card File Description                                            | ✓          |      |
| 6.2                      | Smart Card Specifications                |                     |                                                         |                                                                           |            |      |
| 6.2.1                    | Applicability of international standards | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 2 Card General Description                                         | ✓          |      |
| 6.2.2                    | Specific CSC Requirements                | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 2 Card General Description                                         | ✓          |      |
| 6.2.3                    | Smart Card identifier                    | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 4Card File Description                                             | ✓          |      |
| 6.3                      | Smart Card Applications                  |                     |                                                         |                                                                           | ✓          |      |
| 6.3.1                    | General                                  | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 3 Card Layout Design                                               | ✓          |      |
| 6.3.2                    | Common (Public) Application              | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 4.1 Common Application                                             | ✓          |      |
| 6.3.3                    | Service Provider (Private) Application   | BSVB.00001 Rev.3.0  | NC Card Data Definition                                 | Clause 4.2-4.9 Reserved Application (AID 2-9)                             | ✓          |      |
| 6.4                      | Smart Card Products                      |                     |                                                         |                                                                           |            |      |
| 6.4.1                    | General                                  | BSVB.00001 Rev. 3.0 | NC Card Data Definition                                 | Clause 2.7 Application Master Key Settings<br>Clause 3.2 Card File Design | ✓          |      |
| 6.4.2                    | Client Identification                    | BSW.00010 Rev.2.0   | Issuer Subsystem Design Specification                   | Clause 5.1 Module Design<br>Clause 5.2 Data Design                        | ✓          |      |

| Technical Specifications |                                                   | Design Documents   |                                                     |                                                                                     | Compliance | Note            |
|--------------------------|---------------------------------------------------|--------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|------------|-----------------|
| No.                      | Topic                                             | Document           | Document                                            | Topic                                                                               |            |                 |
|                          |                                                   | BSWV.00010 Rev.2.0 | Issuer Subsystem Design Specification               | Clause 5.1.2<br>Account Management Design<br>Clause 5.2.1ServiceCard Account Design |            |                 |
| 6.4.3                    | Traveler class                                    | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.4                    | Concessions Types                                 | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.5                    | Staff Passes                                      | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.6                    | Common Purse Product                              | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.7                    | Common Products                                   | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.8                    | Provider Specific Products (for information only) |                    |                                                     |                                                                                     |            | For Information |
| 6.4.9                    | Control Data                                      | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
| 6.4.10                   | Transaction Record Register                       | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
|                          |                                                   | BSVB.00012 Rev.2.0 | Transaction Data Definition                         | Clause 5 Transaction Message Data Records                                           |            |                 |
| 6.4.11                   | Last Add-value register                           | BSWV.00009 Rev.2.0 | Financial Management Subsystem Design Specification | Clause 3.1 Financial Management Subsystem Dependencies                              | ✓          |                 |
|                          |                                                   | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       | ✓          |                 |
|                          |                                                   | BSVB.00012 Rev.2.0 | Transaction Data Definition                         | Clause 5 Transaction Message Data Records                                           | ✓          |                 |
| 6.4.12                   | Last Usage Register                               | BSWV.00009 Rev.2.0 | Financial Management Subsystem Design Specification | Clause 3.1 Financial Management Subsystem Dependencies                              | ✓          |                 |
|                          |                                                   | BSVB.00001 Rev.3.0 | NC Card Data Definition                             | Clause 4.1 Common Application                                                       |            |                 |
|                          |                                                   | BSVB.00012 Rev.2.0 | Transaction Data Definition                         | Clause 5 Transaction Message Data Records                                           |            |                 |
|                          |                                                   |                    |                                                     |                                                                                     |            |                 |

| Technical Specifications |                           | Design Documents   |                             |                                           | Compliance | Note |
|--------------------------|---------------------------|--------------------|-----------------------------|-------------------------------------------|------------|------|
| No.                      | Topic                     | Document           | Document                    | Topic                                     |            |      |
| 6.4.13                   | Journey Tracking Register | BSVB.00001 Rev.3.0 | NC Card Data Definition     | Clause 4.1 Common Application             | ✓          |      |
|                          |                           | BSVB.00012 Rev.2.0 | Transaction Data Definition | Clause 5 Transaction Message Data Records |            |      |
| 6.4.14                   | Data Scratchpad           | BSVB.00001 Rev.3.0 | NC Card Data Definition     | Clause 4.1 Common Application             | ✓          |      |
| 6.4.15                   | Common Loyalty Product    | BSVB.00001 Rev.3.0 | NC Card Data Definition     | Clause 4.1 Common Application             | ✓          |      |

Table 3-7 Traceability Matrix (Volume 3 Part 2 : General Specification (GS) - Annex 6: Business Rules)

| No.   | Technical Specification<br>Topic                 | Design Document    |                        |                                             | Compliance | Note |
|-------|--------------------------------------------------|--------------------|------------------------|---------------------------------------------|------------|------|
|       |                                                  | Document           |                        | No.                                         |            |      |
| 1.2   | General Principles on Common Card                |                    |                        |                                             |            |      |
| 1.2.1 | General                                          | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 1.1 General Principle on Common Card | ✓          |      |
| 1.2.2 | Types of Common Card                             | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 1.1 General Principle on Common Card | ✓          |      |
| 1.2.3 | Interoperable Card                               | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 2.1 Global Concepts                  | ✓          |      |
| 1.3   | Ownership of the National Standard               | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 1.1 General Principle on Common Card | ✓          |      |
| 2     | COMMON CARD ISSUERS                              | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 1.1 General Principle on Common Card | ✓          |      |
| 3     | CARD MANAGEMENT                                  |                    |                        |                                             |            |      |
| 3.1   | Overview                                         | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9 Card Operations                    | ✓          |      |
| 3.1.1 | National Card and Co-Branded Card Initialization | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.1 Card Initialization              | ✓          |      |
| 3.1.2 | Co-Issued Card Initialization                    | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.1 Card Initialization              | ✓          |      |
| 3.2   | Card Sales                                       |                    |                        |                                             |            |      |
| 3.2.1 | General                                          | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.3 Card Sale                        | ✓          |      |
| 3.2.2 | Deposit                                          | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.3.2 Deposit                        | ✓          |      |
| 3.2.3 | Initial Stored Value                             | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.3.3 Initial Common Purse Value     | ✓          |      |

| Technical Specification |                                      | Design Document    |                                                       |                                                                                                | Compliance | Note |
|-------------------------|--------------------------------------|--------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------|------------|------|
| No.                     | Topic                                | Document           | No.                                                   |                                                                                                |            |      |
| 3.2.4                   | Issuance Fee                         | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 9.3.4 Issuance Fee                                                                      | ✓          |      |
| 3.2.5                   | Sales Price                          |                    |                                                       |                                                                                                |            |      |
| 3.2.5(A)                | Common Purse Sale Price              | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 9.3.5 Sales Price                                                                       | ✓          |      |
| 3.2.5 (B)               | Trip /Journey Common Card Sale Price | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 9.3.5 Sales Price                                                                       | ✓          |      |
| 3.3                     | Card Service Centre                  | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 2.1.5 Card Service Centre                                                               | ✓          |      |
| 3.3.1 (A)               | CTC's Dedicated Service Centre       | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 2.1.5 Card Service Centre                                                               | ✓          |      |
| 3.3.1 (B)               | Authorized Service Centre            | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 2.1.5 Card Service Centre                                                               | ✓          |      |
| 3.4                     | Blacklist Management                 | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.5 Blacklist Control                                                                   | ✓          |      |
| 3.5                     | Common Card Status                   |                    |                                                       |                                                                                                |            |      |
| 3.5.1                   | General                              | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3 Common Card Status Control                                                          | ✓          |      |
| 3.5.2                   | Uninitialized card                   | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3.2 Uninitialized Card                                                                | ✓          |      |
| 3.5.3                   | Initialized card                     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3.3 Initialized Card                                                                  | ✓          |      |
| 3.5.4                   | Issued card                          | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3.4 Issued Card                                                                       | ✓          |      |
| 3.5.5                   | Lost/Stolen card                     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3.5 Lost/Stolen Card                                                                  | ✓          |      |
|                         |                                      | BSVB.00040 Rev.1.0 | Action List Management Subsystem Design Specification | Clause 5.1.2 Action list Generation Service<br>Clause 5.1.3 Action list Administration Service |            |      |
| 3.5.6                   | Refunded card                        | BSVB.00013 Rev.2.0 | NC Card Business Rules                                | Clause 7.3.6 Refunded Card                                                                     | ✓          |      |

| Technical Specification |                                                        | Design Document    |                        |                                                                | Compliance | Note |
|-------------------------|--------------------------------------------------------|--------------------|------------------------|----------------------------------------------------------------|------------|------|
| No.                     | Topic                                                  | Document           | No.                    |                                                                |            |      |
| 3.5.7                   | Replaced card                                          | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 7.3.7 Replaced Card                                     | ✓          |      |
| 3.5.8                   | Expired card                                           | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 7.3.8 Expired Card                                      | ✓          |      |
| 3.5.9                   | Idle card                                              | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 7.3.9 Idle Card                                         | ✓          |      |
| 3.5.10                  | Invalid card                                           | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 7.3.10 Invalid Card                                     | ✓          |      |
| 3.6                     | Off-Peak Discount Functionality                        | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 4.2 Off-Peak Discount Functionality                     | ✓          |      |
| 4                       | COMMON CARD PERSONALIZATION                            |                    |                        |                                                                |            |      |
| 4.1                     | National Card and Co-Branded Card Personalization      | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.1.1 National Card and Co-Branded Card Personalization | ✓          |      |
| 4.1.1                   | Level 0: Anonymous Card                                | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.1.1 National Card and Co-Branded Card Personalization | ✓          |      |
| 4.1.2                   | Level 1: Registered Card                               | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.1.1 National Card and Co-Branded Card Personalization | ✓          |      |
| 4.1.3                   | Level 2: Personalized Card                             | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.1.1 National Card and Co-Branded Card Personalization | ✓          |      |
| 4.1.4                   | Disclosure of Personal Information and Confidentiality | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.1.1 National Card and Co-Branded Card Personalization | ✓          |      |
| 5                       | COMMON CARD TYPE (TRAVELER CLASS)                      |                    |                        |                                                                |            |      |
| 5.1.1                   | General                                                | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.2 Common Card Type                                    | ✓          |      |
| 5.1.2                   | Types of Common Card                                   | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.2.1 Type of Common Card                               | ✓          |      |

| Technical Specification |                                       | Design Document    |                        |                                            | Compliance | Note |
|-------------------------|---------------------------------------|--------------------|------------------------|--------------------------------------------|------------|------|
| No.                     | Topic                                 | Document           |                        | No.                                        |            |      |
| 5.1.2 (A)               | Standard Common Card (Default Card)   | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.1 Type of Common Card           | ✓          |      |
| 5.1.2 (B)               | Staff Common Card                     | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.1 Type of Common Card           | ✓          |      |
| 5.1.2 (C)               | Concessionary Common Card             | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.1 Type of Common Card           | ✓          |      |
| 5.2                     | Concessionary Card's Rules            | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 4 Card Promotion                    | ✓          |      |
| 5.2.1                   | Fare Discount                         | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 4.1 Concessionary Card's Rules      | ✓          |      |
| 5.2.2                   | Free Top-up                           | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 4.1 Concessionary Card's Rules      | ✓          |      |
| 5.3                     | The Low-Income Card                   | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.3 Low Income Common Card        | ✓          |      |
| 5.3.1                   | Issuing the Low-Income Card           | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.3 Low Income Common Card        | ✓          |      |
| 5.3.2                   | Uses of Low-Income Card               | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.3 Low Income Common Card        | ✓          |      |
| 5.3.3                   | Expiry                                | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.3 Low Income Common Card        | ✓          |      |
| 5.3.4                   | Negative Value in the Low-Income Card | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.2.3 Low Income Common Card        | ✓          |      |
| 6                       | COMMON CARD PRODUCTS                  |                    |                        |                                            |            |      |
| 6.1.1                   | Overview                              | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.3 Common Card Product             | ✓          |      |
| 6.1.2                   | Standard Common Card Products         | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.3.2 Standard Common Card Products | ✓          |      |
| 6.1.3                   | Specific Issuer Product               | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.3.3 Specific Issuer Product       | ✓          |      |
| 6.2                     | Standard Common Card Products         |                    |                        |                                            |            |      |
| 6.2.1                   | Common Purse (store value)            | BSVB.00013 Rev 2.0 | NC Card Business Rules | Clause 3.4.1 Common Purse (store value)    | ✓          |      |

| Technical Specification |                                                           | Design Document    |                        |                                    | Compliance | Note |
|-------------------------|-----------------------------------------------------------|--------------------|------------------------|------------------------------------|------------|------|
| No.                     | Topic                                                     | Document           |                        | No.                                |            |      |
| 6.2.2                   | Common Pass Product                                       |                    |                        |                                    |            |      |
| 6.2.2(A)                | Description                                               | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.4.2 Common Pass Product   | ✓          |      |
| 6.2.2(B)                | Condition of Uses                                         | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.4.2 Common Pass Product   | ✓          |      |
| 6.2.3                   | Fixed Journey product                                     |                    |                        |                                    |            |      |
| 6.2.3(A)                | Description                                               | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.4.3 Fixed Journey Product | ✓          |      |
| 6.2.3(B)                | Condition of Uses                                         | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.4.3 Fixed Journey Product | ✓          |      |
| 6.2.4                   | Common Loyalty Product                                    | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.4.4 Fixed Loyalty Product | ✓          |      |
| 6.3                     | Specific Issuer Product                                   |                    |                        |                                    |            |      |
| 6.3.1                   | Co-Branded Card Product                                   | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.5 Specific Issuer Product | ✓          |      |
| 6.3.2                   | Co-Issued Card Product                                    | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.5 Specific Issuer Product | ✓          |      |
| 6.4                     | Common Product Issuer                                     | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.6 Common Product Issuer   | ✓          |      |
| 6.5                     | Product Hierarchy                                         |                    |                        |                                    |            |      |
| 6.5.1                   | Multiple Product on the Card                              | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.7 Product Hierarchy       | ✓          |      |
| 6.5.2                   | Multiple Promotion in the Card on Non-Transit Transaction | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 3.7 Product Hierarchy       | ✓          |      |
| 7                       | <b>Refund and Replacement of Common Card</b>              |                    |                        |                                    |            |      |
| 7.1                     | Refund of Common Purse                                    | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.13 Card Refund            | ✓          |      |
| 7.2                     | Refund of Lost/Stolen Card                                | BSVB.00013 Rev.2.0 | NC Card Business Rules | Clause 9.13 Card Refund            | ✓          |      |

| Technical Specification |                                    | Design Document    |                                                                   |                                       | Compliance | Note |
|-------------------------|------------------------------------|--------------------|-------------------------------------------------------------------|---------------------------------------|------------|------|
| No.                     | Topic                              | Document           |                                                                   | No.                                   |            |      |
| 7.3                     | Replacement of Damaged Common Card |                    |                                                                   |                                       |            |      |
| 7.3.1                   | Non-Replaceable Damaged Cards      | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.14 Card Replacement          | ✓          |      |
| 7.3.2                   | Replaceable Damaged Cards          | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.14 Card Replacement          | ✓          |      |
| 7.3.3                   | Refund of Invalid Card             | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.14 Card Replacement          | ✓          |      |
| 8                       | Disclosure of Transaction Report   |                    |                                                                   |                                       |            |      |
| 8.1                     | Transaction Report                 | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 10 Card Transaction Constraint | ✓          |      |
| 8.2                     | Request for Transaction Report     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 10 Card Transaction Constraint | ✓          |      |
| 8.3                     | Traffic Report                     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 10 Card Transaction Constraint | ✓          |      |
| 9                       | TOP-UP                             |                    |                                                                   |                                       |            |      |
| 9.1                     | General                            | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.7 Purse Top-up Value         | ✓          |      |
| 9.2                     | Automatic Top-up                   | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.8 Automatic Top up           | ✓          |      |
|                         |                                    | BSVB.00041 Rev.2.0 | Autoload Management<br>Subsystem Software<br>Design Specification | Clause 5.1 Module Design              |            |      |
| 9.2.1 (A)               | Automatic Common Purse Top-Up      | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.8 Automatic Top up           | ✓          |      |
|                         |                                    | BSVB.00041 Rev.2.0 | Autoload Management<br>Subsystem Software<br>Design Specification | Clause 5.1 Module Design              |            |      |
| 9.2.1 (B)               |                                    | BSVB.00013 Rev.2.0 | NC Card Business Rules                                            | Clause 9.8 Automatic Top up           | ✓          |      |

| Technical Specification |                                         | Design Document    |                                                              |                                                           | Compliance | Note |
|-------------------------|-----------------------------------------|--------------------|--------------------------------------------------------------|-----------------------------------------------------------|------------|------|
| No.                     | Topic                                   | Document           | Document                                                     | No.                                                       |            |      |
|                         | Automatic Renewing Period-based product | BSVB.00041 Rev.2.0 | Autobload Management Subsystem Software Design Specification | Clause 5.1 Module Design                                  |            |      |
| 10                      | TRANSFER SCHEME                         |                    |                                                              |                                                           |            |      |
| 10.1                    | General                                 | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 10.2                    | Transfer Rules                          |                    |                                                              |                                                           |            |      |
| 10.2.1                  | General Conditions                      | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
|                         |                                         | BSVB.00001 Rev.3.0 | NC Card Data Definition                                      | Clause 4 Card File Description                            |            |      |
| 10.2.1 (A)              | Distance travelled condition            | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 10.2.1 (B)              | Transfer Time condition                 | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 10.2.1 (C)              | Number of Transfers                     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 10.2.2                  | Applications of the Transfer Scheme     | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 10.2.3                  | Transfer Scheme Renewal                 | BSVB.00013 Rev.2.0 | NC Card Business Rules                                       | Clause 4.4 Transfer Scheme                                | ✓          |      |
| 11                      | TRANSACTION FEE                         |                    |                                                              |                                                           |            |      |
| 11.1                    | General rules in Transaction Fee        | BSVV.00009 Rev.2.0 | Financial Management Subsystem Software Design Specification | Clause 2.1.1 Financial Management Subsystem Decomposition | ✓          |      |
| 11.2                    | Merchant Discount Rate ("MDR")          | BSVV.00009 Rev.2.0 | Financial Management Subsystem Software Design Specification | Clause 5.1.5 Fee Management Service Detailed Design       | ✓          |      |

| Technical Specification |                                                 | Design Document                          |                                                                                        |                                                                                | Compliance | Note |
|-------------------------|-------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------|------|
| No.                     | Topic                                           | Document                                 | No.                                                                                    |                                                                                |            |      |
| 11.3                    | Interchange fee                                 | BSVV.00009 Rev.2.0                       | Financial Management Subsystem Software Design Specification                           | Clause 5.1.5 Fee Management Service Detailed Design                            | ✓          |      |
| 11.4                    | Data Processing fee                             | BSVV.00009 Rev.2.0                       | Financial Management Subsystem Software Design Specification                           | Clause 5.1.5 Fee Management Service Detailed Design                            | ✓          |      |
| 12                      | REVENUE APPORTIONMENT RULES                     |                                          |                                                                                        |                                                                                |            |      |
| 12.1                    | General                                         | BSVB.00013 Rev.2.0<br>BSVV.00009 Rev.2.0 | NC Card Business Rules<br>Financial Management Subsystem Software Design Specification | Clause 6 Trip Fare Computing<br>Clause 5.1.2 Apportioned service Detail design | ✓          |      |
| 12.2                    | Revenue Apportionment Rules for Transfer Scheme | BSVB.00013 Rev.2.0                       | NC Card Business Rules                                                                 | Clause 6 Trip Fare Computing                                                   | ✓          |      |



## Chapter 4 Performance Evaluation and Suggestions

#### 4.1 Performance Evaluation

Regarding the performance evaluation of the Establishment of the Central Clearing House Project, the PMS Consulting Group evaluates the project's management, workmanship, equipment used in the project, and the project's achievement. The evaluation can be classified into project management evaluation, project works evaluation, and overall project completion evaluation. The PMS Consulting Group evaluates the BSV Consortium's performance based on the following criteria;

Table 4-1 PMS Consulting Group's Scoring Criteria

| Scoring Criteria | Score Rating |
|------------------|--------------|
| Very Good        | 5            |
| Good             | 4            |
| Average          | 3            |
| Fair             | 2            |
| Poor             | 1            |

##### 1. Project Management

The project management does not only focus on proficiency of the main project personnel who manage and control the project such as project manager or specialists, but also evaluate the Contractor's organization, including the work plan, document delivery plan and project coordination.

Table 4-2 Project Management Evaluation

| No. | Details                                                                                  | Scoring |   |   |   |   |
|-----|------------------------------------------------------------------------------------------|---------|---|---|---|---|
|     |                                                                                          | 1       | 2 | 3 | 4 | 5 |
| 1   | Project Management                                                                       |         |   |   |   |   |
| 1.1 | Appropriateness of Contractor's organization overview                                    |         |   |   |   | ✓ |
| 1.2 | Working in cooperation and coordination between employers and employer's representatives |         |   |   | ✓ |   |
| 1.3 | Meeting Attendance                                                                       |         |   |   |   | ✓ |
| 1.4 | Response/works according to employers' suggestions/opinion                               |         |   |   |   | ✓ |
| 1.5 | Delivery of main operational plan and updated plan                                       |         |   |   | ✓ |   |
| 1.6 | Delivery of project-related documents                                                    |         |   |   | ✓ |   |

| No.   | Details                                                                                                               | Scoring |   |   |   |   |
|-------|-----------------------------------------------------------------------------------------------------------------------|---------|---|---|---|---|
|       |                                                                                                                       | 1       | 2 | 3 | 4 | 5 |
| 1.7   | Informing employers about project's delay, problems and corrections in order to complete the task within the schedule |         |   |   |   | ✓ |
| Total |                                                                                                                       | 32/35   |   |   |   |   |

### The Consultants' Opinion

The PMS consulting group considers the overview of project management and finds that the BSV's Organization Chart is appropriate for the project's operation. The BSV Consortium assigns Project Manager and Assistant Project Manager for overall management. Quality Manager is responsible for control the works quality include project documents, project timeline and project coordination. In addition, there is a head of technical groups related to hardware and software, training and testing.

Regarding meeting attendance and project coordination, the BSV Consortium sends their representatives to attend a weekly meeting for the project's progress report and discussion about problem solutions with the OTP and PMS consulting group regularly. Moreover, they also attend coordination meetings with transit service providers and banks.

However, concerning the project documents' delivery plan and schedule sent by the BSV Consortium, it does not conform to the plan. It is approximately 1 month behind the schedule. Such delay leads to the project's delay as well, since some works required the document approved from OTP before the implementation.

## 2. Project Work

In the project's works, the Contractors have to provide proficient and sufficient staff for effective operation and keeping up with the timeframe as stipulated in the Contract. They also have to provide necessary software and equipment for the project's works. It includes coordination with employers and the third party to acquire necessary information for the works.

Table 4-3 Project Performance Evaluation

| No.   | Details                                  | Scoring |   |   |   |   |
|-------|------------------------------------------|---------|---|---|---|---|
|       |                                          | 1       | 2 | 3 | 4 | 5 |
| 2     | Project Works                            |         |   |   |   |   |
| 2.1   | Total works effectiveness                |         |   |   |   | ✓ |
| 2.2   | Providing sufficient equipment for works |         |   |   |   | ✓ |
| 2.3   | Providing necessary software for works   |         |   |   |   | ✓ |
| 2.4   | Quality of workmanship                   |         |   |   |   | ✓ |
| 2.5   | Providing sufficient staff for works     |         |   |   | ✓ |   |
| Total |                                          | 19/20   |   |   |   |   |

### The Consultants' Opinion

At the beginning, the manpower provided by the BSV Consortium are suitable for the project's works and in accordance with the OTP's requirements. They are experienced in the CCH's development. This includes supporting staff in various departments. The PMS Consulting Group and the OTP believe that they are sufficient for the project's works for keeping up with the timeframe stipulated in the Contract. However, the works is behind the schedule, so the PMS consulting group suggests that the BSV Consortium should recruits the additional staff to speed up the works and completes it within the schedule.

In the project, the BSV Consortium provides software as stipulated by the Contract for use in both the Microsoft Project which is responsible for works plan management throughout the project, and Alfresco program which is responsible for control and management of all incoming and outgoing documents, including providing equipment such as computers for the project.

### 3. Project's Overall Completion

This section focuses on the project evaluation results whether they are in consistent with the project's requirements and objectives and whether the project is operated according to the Contract's timeframe. This evaluates the completion of each works pertaining design, system implementation and testing.

Table 4-4 Evaluation of Project Overall Success

| No.   | Details                                                                                                                    | Scoring |   |   |   |   |
|-------|----------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|---|
|       |                                                                                                                            | 1       | 2 | 3 | 4 | 5 |
| 3     | Consistency between the works and the employer's requirements                                                              |         |   |   |   |   |
| 3.1   | The works is corrected and acomplied with the requirements                                                                 |         |   |   |   | ✓ |
| 3.2   | The operation is completed according to the scope of works as stipulated in the Contract                                   |         |   |   |   | ✓ |
| 3.3   | The project's works is in consistent with the timeframe and completed according to the schedule stipulated in the contract |         |   |   | ✓ |   |
| Total |                                                                                                                            | 14/15   |   |   |   |   |

#### The Consultants' Opinion

At present, the Establishment of the Central Clearing House Project is under the system implementation process. However, during the design process it is approximately one month behind the schedule.

Regarding the design's correction and completion, the PMS Consulting Group check the BSV Consortium's design and decide that its design already meets to the OTP's requirements.

### 4.2 Suggestions

1. Since the current operation is currently behind the schedule, a key date for certain task that can affect the operation term should be determined in order to accelerate the CCH Contractor to keep up with the master schedule.
2. Key Date should be determined for a coordination in order to request for information and system integration.
3. The system developers should be accelerated to deliver required documents as stated in the submittal schedule which is submitted at the beginning of the project for approval.

4. The CCH Contractor should provide more manpower to accelerate the works according to the plan.
5. The Office of Transport and Traffic Policy and Planning (OTP) should set up the Common Ticketing Company (CTC)'s manager for the CCH's management as soon as possible, because a certain task requires the CTC's opinion since it affects the future operations.

## Appendix A      Summary of the Consultant Opinion on the Establishment of the Central Clearing House Project Documents

Table of PMS Comments for BSV Submission  
Establishment of the Central Clearing House (CCH)

| No. | Doc. No.   | Description                     | Rev. | Date      | Document Review                                                                                                                                                                       |                              | Note |
|-----|------------|---------------------------------|------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
|     |            |                                 |      |           | PMS Comments                                                                                                                                                                          | Comment Category             |      |
| 1   |            |                                 |      |           | Project Management                                                                                                                                                                    |                              |      |
| 1.1 | BSVB.00003 | Staff Organization Plan         | 1.0  | 17 Mar 15 | Document complies with the requirement                                                                                                                                                | No Objection                 |      |
| 1.2 | BSVB.00004 | Outline Quality Management Plan | 1.0  | 17 Mar 15 | Recommend to set up the quality target and CCH Project Quality Assurance Related document                                                                                             | No Objection with Comments   |      |
|     |            |                                 | 2.0  | 3 Jul 15  | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                     | No Objection                 |      |
| 1.3 | BSVB.00009 | Quality Management Plan         | 1.0  | 3 Jul 15  | Recommend the clear responsibility of the party in the CCH project such as Project Steering Committee etc. and the detailed exact understanding of the Quality Assurance Process Flow | Request for more information |      |
|     |            |                                 | 2.0  | 6 Aug 15  | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                     | No Objection                 |      |

| No. | Doc. No.   | Description        | Rev. | Date      | Document Review                                                                                                                                                                                                                                                  |                            | Note |
|-----|------------|--------------------|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |            |                    |      |           | PMS Comments                                                                                                                                                                                                                                                     | Comment Category           |      |
| 1.4 | BSVB.00002 | Submittal Schedule | 1.0  | 17 Mar 15 | Recommend to include the list of maintenance manual in the submittal schedule document<br><br>Recommend the tool that can be used to manage submissions such as Excel<br><br>Consider to break down the end date because many documents have same expected date. | No Objection with Comments |      |
|     |            |                    | 2.0  | 19 May 15 | Consider to check the sequence of document submission date that the Requirements Specification are completed before Design Specification are submitted                                                                                                           | No Objection with Comments |      |
|     |            |                    | 3.0  | 28 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                | No Objection               |      |

| No. | Doc. No.   | Description                      | Rev. | Date      | Document Review                                                                                                  |                            | Note |
|-----|------------|----------------------------------|------|-----------|------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |            |                                  |      |           | PMS Comments                                                                                                     | Comment Category           |      |
| 1.5 | BSVB.00006 | Initial Work Program             | 1.0  | 17 Mar 15 | 1. The work program should have more detail and Acceptance tests schedule shall be added                         | No Objection with Comments |      |
|     |            |                                  |      |           | 2. The format of submission No. in this document is different from the submitted document                        |                            |      |
|     |            |                                  |      |           | 3. Recommend to describe the clear participant name or role in the Monthly meeting and Technical meeting section |                            |      |
| 1.6 | BSVB.00008 | Coordinated Implementation Plans | 2.0  | 19 May 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                | No Objection               |      |
|     |            |                                  | 1.0  | 12 May 15 | Document complies with the requirement                                                                           | No Objection               |      |

| No. | Doc. No.                | Description                      | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                        |                            | Note |
|-----|-------------------------|----------------------------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |                         |                                  |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                           | Comment Category           |      |
| 2   | Design Document         |                                  |      |           |                                                                                                                                                                                                                                                                                                                                        |                            |      |
| 1   | Architectural Documents |                                  |      |           |                                                                                                                                                                                                                                                                                                                                        |                            |      |
| 1.1 | BSVV.00001              | System Architecture              | 1.0  | 23 Apr 15 | 1. Recommend to add the detail of Overall architecture<br>2. The subsystem need to be checked, revised and added more detail<br>3. Recommend to add detail of the Security Subsystem<br>4. The Communication Subsystem and Interfacing (both interface within CCH and interface CCH with the 3 <sup>rd</sup> party) need to be checked | No Objection with comments |      |
|     |                         |                                  | 2.0  | 28 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                      | No Objection               |      |
| 1.2 | BSVB.00010              | Technical & Network Architecture | 1.0  | 23 Apr 15 | 1. Recommend to explain the Overall CCH System Architecture<br>2. The subsystem need to be checked, revised and added more detail<br>3. Recommend to add the detail of the System Performance<br>4. Recommend to add the detail of the System Recovery Plan                                                                            | No Objection with comments |      |

| No. | Doc. No.   | Description                  | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                            |                            | Note |
|-----|------------|------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |            |                              |      |           | PMS Comments                                                                                                                                                                                                                                                                               | Comment Category           |      |
| 1.3 | BSV.00002  | System Security Architecture | 2.0  | 28 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                          | No Objection               |      |
|     |            |                              | 1.0  | 19 Jul 15 | 1. Consider to put Web Safeguard so that OTP CCH can provide Web Portal service safely<br>2. Required the list and description of the solutions, devices, modules for the System Security Architecture                                                                                     | No Objection with comments |      |
|     |            |                              | 2.0  | 16 Jun 15 | Required more detail of the encryption for the data protection(e.g. Cardholder name, Phone Number, address)                                                                                                                                                                                | No Objection with comments |      |
|     |            |                              | 3.0  | 14 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                          | No Objection               |      |
| 1.4 | BSVB.00001 | NC Card Data Definition      | 1.0  | 9 Mar 15  | 1. Required the explanation of; how to manage the transfer requirements of GS Annex 6 Business Rules, Clause 10.2.1(A), How to handle the Expressway transaction and the Bus Validation file in the card layout?<br>2. Recommend to provide details of an alternative / second-source CSC. | No Objection with comments |      |
|     |            |                              | 2.0  | 11 Jun 15 | Required the clarification for the "second source" suppliers                                                                                                                                                                                                                               | No Objection with comments |      |

| No. | Doc. No.               | Description                                                 | Rev. | Date      | Document Review                                                                                                                                      |                            | Note |
|-----|------------------------|-------------------------------------------------------------|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |                        |                                                             |      |           | PMS Comments                                                                                                                                         | Comment Category           |      |
|     |                        |                                                             | 3.0  | 10 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                    | No Objection               |      |
| 1.5 | BSVB.00011             | Configuration Parameters                                    | 1.0  | 11 Jun 15 | The content in the document need to be check                                                                                                         | No Objection with comments |      |
|     |                        |                                                             | 2.0  | 10 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                    | No Objection               |      |
| 1.6 | BSVB.00012             | Transaction Data Definition                                 | 1.0  | 11 Jun 15 | The document need to be fill in completely                                                                                                           | No Objection with comments |      |
|     |                        |                                                             | 2.0  | 10 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                    | No Objection               |      |
| 1.7 | BSVB.00013             | NC Card Business Rules                                      | 1.0  | 11 Jun 15 | Consider to provide the clear transfer time                                                                                                          | No Objection               |      |
|     |                        |                                                             | 2.0  | 10 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                    | No Objection               |      |
| 2   | Requirements Documents |                                                             |      |           |                                                                                                                                                      |                            |      |
| 2.1 | BSVB.00014             | Access Control Subsystem Software Requirement Specification | 1.0  | 28 May 15 | Recommend to add the detail of the Cardholder Web Portal and SP Web Portal for PMS consider that the document is matched with the requirement of TOR | No Objection with comments |      |
|     |                        |                                                             | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                    | No Objection               |      |

| No.  | Doc. No.   | Description                                                                          | Rev. | Date      | Document Review                                                                                                                                                                                                                   |                            | Note                                                                                                                                           |
|------|------------|--------------------------------------------------------------------------------------|------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|      |            |                                                                                      |      |           | PMS Comments                                                                                                                                                                                                                      | Comment Category           |                                                                                                                                                |
| 2.2. | BSVB.00015 | Action List Management Subsystem Software Requirement Specification                  | 1.0  | 16 Jun 15 | Document complies with the requirement                                                                                                                                                                                            | No Objection               |                                                                                                                                                |
| 2.3  | BSVB.00016 | Autoload Management Subsystem Software Requirement Specification                     | 1.0  | 16 Jun 15 | Recommend to add the detail of the relationship between Autoload subsystem and Cardholder both interfacing and working process                                                                                                    | No Objection               | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 2.4  | BSVB.00017 | Card Inventory Management Subsystem Software Requirement Specification               | 1.0  | 10 Jun 15 | Document complies with the requirement                                                                                                                                                                                            | No Objection               |                                                                                                                                                |
| 2.5  | BSVS.00003 | Card Initialization and Personalization Subsystem Software Requirement Specification | 1.0  | 28 Jul 15 | 1. Card Level need to be revised according to BSVB.00013 NC Card Business Rule<br>2. The Personalized Card surface printing function of The Card Initialization and Personalization Device need the detail of printed information | No Objection with comments |                                                                                                                                                |
|      |            |                                                                                      | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                 | No Objection               |                                                                                                                                                |
| 2.6  | BSVB.00018 | Communication Subsystem Requirement Specification                                    | 1.0  | 18 Jun 15 | Recommend to recheck and confirm that the developed system has been used the Communication Middleware and the Online Communication need more technical detail                                                                     | No Objection               | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |

| No. | Doc. No.   | Description                                                                | Rev. | Date      | Document Review                                                                                                                  |                  | Note                                                                                                                                           |
|-----|------------|----------------------------------------------------------------------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|     |            |                                                                            |      |           | PMS Comments                                                                                                                     | Comment Category |                                                                                                                                                |
| 2.7 | BSVB.00101 | Configuration Data Management Subsystem Software Requirement Specification | 1.0  | 16 Jun 15 | Recommend to add more details of bus route, bus stop and SP device Parameter                                                     | No Objection     | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 2.8 | BSVB.00019 | Device Management Subsystem Software Requirement Specification             | 1.0  | 28 May 15 | Recommend to add detail of the device status when they are ready to use to ensure the documents is matched with the Requirements | No Objection     | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 2.9 | BSVV.00003 | Financial Management Subsystem Software Requirement Specification          | 1.0  | 9 Jun 15  | Recommend to add detail of Multi Card Issuer System and revise the interfacing to match the Requirements                         | No Objection     | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |

| No.  | Doc. No.   | Description                                                 | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                                                         |                            | Note                                                                                                                                           |
|------|------------|-------------------------------------------------------------|------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|      |            |                                                             |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                                                            | Comment Category           |                                                                                                                                                |
| 2.10 | BSVB.00020 | Host Security Management Software Requirement Specification | 1.0  | 26 Jun 15 | 1. Recommend to add the TCP/IP protocol usage detail and Key Export Function<br>2. Recommend to recheck the RS232 that use for the communication between the Control Console and HSM.<br>3. Key Export function should be consider the security of data transmission<br>4.HSM should support both online and offline mode without any impact to the working performance | No Objection with comments |                                                                                                                                                |
|      |            |                                                             | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                                                       | No Objection               |                                                                                                                                                |
| 2.11 | BSV.00004  | Issuer Subsystem Software Requirement Specification         | 1.0  | 9 Jun 15  | Recommend to add more Issuer Validation Service detail to ensure the documents is matched with the Requirements and working efficiently                                                                                                                                                                                                                                 | No Objection               | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 2.12 | BSVS.00004 | Key Management Subsystem Software Requirement Specification | 1.0  | 28 Jul 15 | Recommend to add more detail of HSM interface and administrators via TCP/IP protocol                                                                                                                                                                                                                                                                                    | No Objection with comments |                                                                                                                                                |
|      |            |                                                             | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                                                       | No Objection               |                                                                                                                                                |

| No.  | Doc. No.   | Description                                                     | Rev. | Date      | Document Review                                                                                                                                                                                                                                                        |                            | Note                                                                                                                                           |
|------|------------|-----------------------------------------------------------------|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|      |            |                                                                 |      |           | PMS Comments                                                                                                                                                                                                                                                           | Comment Category           |                                                                                                                                                |
| 2.13 | BSVV.00014 | Online Enquiry Software Requirement Specification               | 1.0  | 11 Jun 15 | Document complies with the requirement                                                                                                                                                                                                                                 | No Objection               |                                                                                                                                                |
| 2.14 | BSVB.00022 | Report Management Subsystem Software Requirement Specification  | 1.0  | 16 Jun 15 | Recommend to add more detail of Financial Report and Reconcile Report                                                                                                                                                                                                  | No Objection               | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 2.15 | BSVV.00023 | Systems Management Subsystem Software Requirement Specification | 1.0  | 16 Jun 15 | Recommend to include Self-diagnostics function , Archival function and System Operation Log Management function in Maintenance Management                                                                                                                              | No Objection with comments |                                                                                                                                                |
|      |            |                                                                 | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                      | No Objection               |                                                                                                                                                |
| 2.16 | BSVV.00005 | Cardholder Software Requirement Specification                   | 1.0  | 19 Jun 15 | 1. Recommended that the mobile users could access the cardholder website directly<br>2. Recommend to revise the "if applicable" of some data such as Product Balance, Transaction Value and Penalty details because they are the essential data for the card services. | No Objection with comments |                                                                                                                                                |

| No.  | Doc. No.   | Description                                                  | Rev. | Date      | Document Review                                                                                                                                                      |                            | Note |
|------|------------|--------------------------------------------------------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|      |            |                                                              |      |           | PMS Comments                                                                                                                                                         | Comment Category           |      |
|      |            |                                                              | 2.0  | 29 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                    | No Objection               |      |
| 2.17 | BSVB.00114 | SP Website Software Requirement Specification                | 1.0  | 16 Jun 15 | More detailed requirement of using the offline database should be described                                                                                          | No Objection with comments |      |
|      |            |                                                              | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                    | No Objection               |      |
| 2.18 | BSVB.00105 | Payment Gateway Software Requirement Specification           | 1.0  | 26 Jun 15 | Document complies with the requirement                                                                                                                               | No Objection               |      |
| 2.19 | BSVS.00078 | SAM Requirement Specification                                | 1.0  | 28 Jul 15 | 1. Recommend to add the interface requirement of KMS and SAM Personalization<br>2. BSV to confirm that the "SAM personalization machine" is in project scope of work | No Objection with comments |      |
|      |            |                                                              | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                    | No Objection               |      |
| 2.20 | BSVS.00069 | Refund and Reload Machine Software Requirement Specification | 1.0  | 28 Jul 15 | 1. Card Level need to be revised according to BSVB.00013 NC Card Business Rule<br>2. Recommend to correct the condition of personal information printed on card      | No Objection with comments |      |

| No. | Doc. No.            | Description                                                                                                             | Rev. | Date      | Document Review                                                                                              |                            | Note                                                                                                                             |
|-----|---------------------|-------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
|     |                     |                                                                                                                         |      |           | PMS Comments                                                                                                 | Comment Category           |                                                                                                                                  |
|     |                     |                                                                                                                         | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                            | No Objection               |                                                                                                                                  |
| 3   | Interface Documents |                                                                                                                         |      |           |                                                                                                              |                            |                                                                                                                                  |
| 3.1 | BSVB.00025          | Bank Interface Specification                                                                                            | 1.0  | 24 Jun 15 | Recommend to add the detail of layout, key attributes and formats of the Financial File and Operational File | No Objection               | BSV has delivered a PMS Comments which has sufficient detailed to determine that the document is complied with the requirements. |
| 3.2 | BSVV.00006          | OTP CCH to Operator Interface Specification Details incorporated into Front End CCH-L3 Detailed Interface Specification | 1.0  | 16 Jun 15 | Recommended Standardized terms for any terms/works refer to SP                                               | No Objection with comments |                                                                                                                                  |
|     |                     |                                                                                                                         | 2.0  | 13 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                            | No Objection               |                                                                                                                                  |
| 3.3 | BSVB.00026          | Equipment Initialization Interface Specification                                                                        | 1.0  | 26 Jun 15 | Recommend to recheck the Service Provider ID, SP ID and Location code                                        |                            |                                                                                                                                  |
|     |                     |                                                                                                                         | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                            | No Objection               |                                                                                                                                  |
| 3.4 | BSVV.00015          | Online Enquiry Subsystem Interface Specification                                                                        | 1.0  | 11 Jun 15 | Recommend to add the detail of Online Interface between SP and CCH                                           | No Objection with comments |                                                                                                                                  |
|     |                     |                                                                                                                         | 2.0  | 13 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                            | No Objection               |                                                                                                                                  |

| No. | Doc. No.         | Description                                                          | Rev. | Date      | Document Review                                                                                                                                                          |                              | Note |
|-----|------------------|----------------------------------------------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
|     |                  |                                                                      |      |           | PMS Comments                                                                                                                                                             | Comment Category             |      |
| 3.5 | BSVB.00106       | Cardholder Website Payment Gateway Subsystem Interface Specification | 1.0  | 26 Jun 15 | Document complies with the requirement                                                                                                                                   | No Objection                 |      |
| 3.6 | BSVS.00079       | SAM Interface Specification                                          | 1.0  | 17 Aug 15 | Recommend to consider that the described SAM interface in this specification is fully covering the all of the interfaces in the respect of SAM operation and management. | Request for more Information |      |
|     |                  |                                                                      | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                        | No Objection                 |      |
| 4   | Design Documents |                                                                      |      |           |                                                                                                                                                                          |                              |      |
| 4.1 | BSVB.00039       | Access Control Subsystem Design Specification                        | 1.0  | 31 Jul 15 | Recommend to add the Table Dependency Description                                                                                                                        | No Objection with comments   |      |
|     |                  |                                                                      | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                        | No Objection                 |      |
| 4.2 | BSVB.00040       | Action List Management Subsystem Design Specification                | 1.0  | 31 Jul 15 | Recommend to correct the document structure according to the standard document                                                                                           | No Objection with comments   |      |
|     |                  |                                                                      | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                        | No Objection                 |      |

| No. | Doc. No.   | Description                                                            | Rev. | Date      | Document Review                                                                                                                                                         |                              | Note                                                                                                                             |
|-----|------------|------------------------------------------------------------------------|------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
|     |            |                                                                        |      |           | PMS Comments                                                                                                                                                            | Comment Category             |                                                                                                                                  |
| 4.3 | BSVB.00041 | Autoload Management Subsystem Design Specification                     | 1.0  | 13 Aug 15 | 1. Recommend to correct the document structure according to the standard document<br>2. Request for information of Cardholder <<subsystem>> and Cardholder <<database>> | No Objection with comments   |                                                                                                                                  |
|     |            |                                                                        | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                       | No Objection                 |                                                                                                                                  |
| 4.4 | BSVB.00042 | Card Inventory Management Subsystem Design Specification               | 1.0  | 31 Jul 15 | Recommend to consider the data transmission of Offline Server Inventory Management Module                                                                               | No Objection with comments   | BSV has delivered a PMS Comments which has sufficient detailed to determine that the document is complied with the requirements. |
| 4.5 | BSVS.00009 | Card Initialization and Personalization Subsystem Design Specification | 1.0  | 17 Aug 15 | Recommend to clarify the difference between this document and BSVS.00003 CIPS Software Requirement Specification                                                        | Request for more Information |                                                                                                                                  |
|     |            |                                                                        | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                       | No Objection                 |                                                                                                                                  |

| No. | Doc. No.   | Description                                                           | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                                                  |                            | Note |
|-----|------------|-----------------------------------------------------------------------|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |            |                                                                       |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                                                     | Comment Category           |      |
| 4.6 | BSVB.00043 | Communications Subsystem System Design Specification                  | 1.0  | 13 Aug 15 | 1. Recommend to correct the document structure according to the standard document and use the unified word description<br>3. Recommend to clarify the difference between CIPD and Reload and Refund Facility<br>4. Recommend to check the coherence of documents<br>5. Recommend to consider the transaction recovery or resending in the manner of FTP or SFTP. | No Objection with comments |      |
|     |            |                                                                       | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                                                | No Objection               |      |
| 4.7 | BSVB.00116 | Configuration Data Management Subsystem Software Design Specification | 1.0  | 31 Jul 15 | Recommend to add the list of Table and fill in Table and Figure completely                                                                                                                                                                                                                                                                                       | No Objection with comments |      |
|     |            |                                                                       | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                                                | No Objection               |      |

| No. | Doc. No.   | Description                                                  | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                       |                            | Note |
|-----|------------|--------------------------------------------------------------|------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |            |                                                              |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                          | Comment Category           |      |
| 4.8 | BSVB.00044 | Device Management Subsystem Software Design Specification    | 1.0  | 31 Aug 15 | 1. Recommend to redefine the description of SAM ID. Because the descriptions of Device ID and SAM ID are difference and recommended that "If the device not has the SAM", this field value is NULL, not the value of Device ID<br>2. Recommend to fill in Table and Figure completely                                                 | No Objection with comments |      |
|     |            |                                                              | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                     | No Objection               |      |
| 4.9 | BSVV.00009 | Financial Management Subsystem Software Design Specification | 1.0  | 14 Aug 15 | 1. Recommend to fill in Table and Figure completely<br>2. Recommend to add the description of banking monetary transfer fee. Additionally this fee is to be considered for the more exact calculation.<br>3. Recommend to consider the comment on the zero balance because the suggest model of settlement has the charge fee to SPs. | No Objection with comments |      |
|     |            |                                                              | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                     | No Objection               |      |

| No.  | Doc. No.   | Description                                                      | Rev. | Date      | Document Review                                                                                                                          |                            | Note                                     |
|------|------------|------------------------------------------------------------------|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------|
|      |            |                                                                  |      |           | PMS Comments                                                                                                                             | Comment Category           |                                          |
| 4.10 | BSVB.00045 | Host Security Management Subsystem Software Design Specification | 1.0  | 13 Aug 15 | Recommend to check the possibility of data transmission via TCP / IP instead of RS232.                                                   | No Objection with comments |                                          |
|      |            |                                                                  | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                        | No Objection               |                                          |
| 4.11 | BSV.00010  | Issuer Subsystem Design Specification                            | 1.0  | 29 Jul 15 | 1. Recommend to correct the document structure according to the standard document<br>2. Recommend to fill in Table and Figure completely | No Objection with comments |                                          |
|      |            |                                                                  | 2.0  | 28 Aug 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                        | No Objection               |                                          |
| 4.12 | BSVS.00010 | Key Management Subsystem Design Specification                    | 1.0  | 13 Aug 15 | Document complies with the requirement                                                                                                   | No Objection               |                                          |
|      |            |                                                                  | 2.0  | 15 Sep 15 | Document complies with the requirement                                                                                                   | No Objection               | BSV add more details of working function |
| 4.13 | BSV.00016  | Online Enquiry Subsystem Design Specification                    | 1.0  | 22 Jul 15 | Document complies with the requirement                                                                                                   | No Objection               |                                          |

| No.  | Doc. No.   | Description                                                | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                            |                              | Note |
|------|------------|------------------------------------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
|      |            |                                                            |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                               | Comment Category             |      |
| 4.14 | BSVB.00046 | Report Management Subsystem Design Specification           | 1.0  | 13 Aug 15 | 1. Recommend to correct the document structure according to the standard document and fill in Table and Figure completely<br>2. Recommend to add Auto Top up Activation Transaction by Service Provider Report<br>3. Request the confirmation that the report can be modified when CTC go lives e.g. generate weekly/monthly/ad-hoc report | No Objection with comments   |      |
|      |            |                                                            | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                          | No Objection                 |      |
| 4.15 | BSVB.00047 | Systems Management Subsystem Software Design Specification | 1.0  | 13 Aug 15 | 1. Recommend to fill in the lost figure<br>2. Request the supporting information of ORACLE RAC use for DR System e.g. the system performance test result                                                                                                                                                                                   | No Objection with comments   |      |
|      |            |                                                            | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                          | No Objection                 |      |
| 4.16 | BSVS.00011 | Central Clearing House Equipment Rack Plan                 | 1.0  | 28 Aug 15 | The Rack Planning shall include the Host Security Management                                                                                                                                                                                                                                                                               | Request for more Information |      |
|      |            |                                                            | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                                          | No Objection                 |      |

| No.  | Doc. No.   | Description                                 | Rev. | Date      | Document Review                                                                                                                                                                                                                                  |                              | Note |
|------|------------|---------------------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
|      |            |                                             |      |           | PMS Comments                                                                                                                                                                                                                                     | Comment Category             |      |
| 4.17 | BSVB.00048 | Central Clearing House Network Design       | 1.0  | 13 Aug 15 | 1. Recommend to check the ORA-INT IP of Oracle DB1 and ORA-INT IP for Vmware ESX11<br>2. Recommend to add the figure of LAN Topology for more clear understanding,<br>3. Recommend to add NW Configuration of DR center                          | No Objection with comments   |      |
|      |            |                                             | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                | No Objection                 |      |
| 4.18 | BSVB.00049 | Central Clearing House Server System Design | 1.0  | 13 Aug 15 | 1. Capacity planning of server is to be including the amount of Memory size(GB) and CPU Capacity. And supporting information for consider the suitability of equipment<br>2. Recommend to add Server Configuration for more clear understanding, | Request for more Information |      |
|      |            |                                             | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                | No Objection                 |      |

| No.  | Doc. No.   | Description                                       | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                  |                              | Note |
|------|------------|---------------------------------------------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
|      |            |                                                   |      |           | PMS Comments                                                                                                                                                                                                                                                                     | Comment Category             |      |
| 4.19 | BSVV.00011 | Cardholder Website Software Design Specification  | 1.0  | 6 Aug 15  | 1. Recommend to define the specific period to keep the Cardholder Transaction history<br>2. Recommend to revise the cardholder detail according to BSVB.00013 Rev.2.0 NC Card Business Rule<br>3. Recommend to check the consistency of the personal information in the document | No Objection with comments   |      |
|      |            |                                                   | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                | No Objection                 |      |
|      |            |                                                   | 1.0  | 13 Aug 15 | 1. Recommend to add the functionality to download excel typed data sheet for the SP request<br>2. Recommend to fix the duplicate figure                                                                                                                                          | No Objection with comments   |      |
| 4.20 | BSVB.00115 | SP Website Software Design Specification          | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                | No Objection                 |      |
|      |            |                                                   | 1.0  | 13 Aug 15 | 1. Recommend to check the Data Flow that it has the approval process of credit card payment to protect the fraudulent<br>2. Recommend to revise the Data Flow to make the monetary transfer of Non-transit payment transaction more secure.                                      | Request for more Information |      |
|      |            |                                                   | 1.0  | 13 Aug 15 |                                                                                                                                                                                                                                                                                  |                              |      |
| 4.21 | BSVB.00107 | Payment Gateway Subsystem Interface Specification |      |           |                                                                                                                                                                                                                                                                                  |                              |      |

| No.  | Doc. No.   | Description                                             | Rev. | Date      | Document Review                                                                                                                                                                                                                                                                                                                 |                              | Note                                                                                                                                           |
|------|------------|---------------------------------------------------------|------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|      |            |                                                         |      |           | PMS Comments                                                                                                                                                                                                                                                                                                                    | Comment Category             |                                                                                                                                                |
| 4.22 |            |                                                         | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                               | No Objection                 |                                                                                                                                                |
|      | BSVS.00083 | SAM Design Specification                                | 1.0  | 17 Aug 15 | Recommend to add the detail of processes/functions between SAM, card and Host System                                                                                                                                                                                                                                            | No Objection with comments   |                                                                                                                                                |
|      |            |                                                         | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                               | No Objection                 |                                                                                                                                                |
| 4.23 | BSVB.00104 | System security architecture Design Specification       | 1.0  | 7 Aug 15  | 1. Request the clear differences between this documentation and "BSW 00002 Rev.3.0 System Security Architecture.pdf", Documentation scope is to be required in the introduction chapter.<br>2. Request for reason that Non-transit SP System to OTP CCH communication is optionally GPG encrypted rather than using the SP SAM. | No Objection                 | BSV has delivered a PMS Comments clarification which has sufficient detailed to determine that the document is complied with the requirements. |
| 4.24 | BSVS.00084 | Refund and Reload Machine Software Design Specification | 1.0  | 17 Aug 15 | Recommend to check the content because it is perfectly same as BSVS.00009 Rev.1.0 CIPS Design Specification                                                                                                                                                                                                                     | Request for more Information |                                                                                                                                                |
|      |            |                                                         | 2.0  | 22 Jul 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                                                                                                                                               | No Objection                 |                                                                                                                                                |

| No. | Doc. No.   | Description                            | Rev. | Date      | Document Review                                                                                                                                                    |                            | Note                                                                                                                                                                                        |
|-----|------------|----------------------------------------|------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |            |                                        |      |           | PMS Comments                                                                                                                                                       | Comment Category           |                                                                                                                                                                                             |
| 3   |            |                                        |      |           | Development Document                                                                                                                                               |                            |                                                                                                                                                                                             |
| 1.1 | BSVS.00012 | Procurement Plan                       | 1.0  | 28 Aug 15 | Recommend to correct the Document Purpose and revise Project Timeline according to the CCH Contract                                                                | No Objection with comments |                                                                                                                                                                                             |
|     |            |                                        | 2.0  | 15 Sep 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                  | No Objection               |                                                                                                                                                                                             |
| 1.2 | BSVS.00001 | Hardware Bill of Materials             | 1.0  | 28 Aug 15 | Document complies with the requirement                                                                                                                             | No Objection               |                                                                                                                                                                                             |
| 1.3 | BSVS.00002 | Software Bill of Materials             | 1.0  | 30 Aug 15 | Recommend to check the SMS Sever Operating System (OS) because it's not match with the SMS Server OS specified in BSVB.00048 Central Clearing House Network Design | No Objection with comments |                                                                                                                                                                                             |
|     |            |                                        | 2.0  | 5 Oct. 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                  | No Objection               |                                                                                                                                                                                             |
| 1.4 | BSVS.00080 | Third party Software Bill of Materials | 1.0  | 28 Aug 15 | Recommend to check the Software list according to the CCH Contract                                                                                                 | No Objection               | BSV clarify that the missing software is the Software developed by BSV as detailed show in Document No. BSVS.00002 which can determine that the document is complied with the requirements. |

| No. | Doc. No.         | Description                                                              | Rev. | Date       | Document Review                                                                                                                                                                                      |                            | Note |
|-----|------------------|--------------------------------------------------------------------------|------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
|     |                  |                                                                          |      |            | PMS Comments                                                                                                                                                                                         | Comment Category           |      |
| 4   | Testing Document |                                                                          |      |            |                                                                                                                                                                                                      |                            |      |
| 1.1 | BSVB.00005       | Preliminary Test plan                                                    | 1.0  | 17 Mar 15  | Recommend to add the Availability Test in the Test Plan                                                                                                                                              | Objection                  |      |
|     |                  |                                                                          | 2.0  | 19 May 15  | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                    | No Objection               |      |
| 1.2 | BSVB.00068       | Overall Inspection and Test Plan                                         | 1.0  | 6 Aug 15   | Recommend to perform the Performance Test in the Trial Run Period and User Acceptance Test<br>Recommend to add the responsibility of each party include Tester and Test Witness in each test stages. | No Objection with comments |      |
|     |                  |                                                                          | 2.0  | 29 Sep 15  | BSV revise the document follow PMS comments and PMS doesn't have further comments                                                                                                                    | No Objection               |      |
| 1.3 | BSVB.00069       | Functional Acceptance Test Plan                                          | 1.0  | 11 Nov. 15 | Recommend BSV to add the Payment Gateway testing method in the Test Plan                                                                                                                             | No Objection with comments |      |
| 1.4 | BSVB.00071       | Action List Management Subsystem Functional Acceptance Test Procedure    | 1.0  | 14 Nov. 15 | The document is fully detailed and comply with the requirements                                                                                                                                      | No Objection               |      |
| 1.5 | BSVB.00073       | Card Inventory Management Subsystem Functional Acceptance Test Procedure | 1.0  | 14 Nov. 15 | The document is fully detailed and comply with the requirements                                                                                                                                      | No Objection               |      |

| No.  | Doc. No.   | Description                                                                            | Rev. | Date       | Document Review                                                 |                            | Note |
|------|------------|----------------------------------------------------------------------------------------|------|------------|-----------------------------------------------------------------|----------------------------|------|
|      |            |                                                                                        |      |            | PMS Comments                                                    | Comment Category           |      |
| 1.6  | BSVS.00022 | Card Initialization and Personalization Subsystem Functional Acceptance Test Procedure | 1.0  | 17 Jul. 15 | Recommend to correct the access to the Subsystem                | No Objection with comments |      |
| 1.7  | BSVB.00076 | Device Management Subsystem Functional Acceptance Test Procedure                       | 1.0  | 1 Jul. 15  | The document is fully detailed and comply with the requirements | No Objection               |      |
| 1.9  | BSVS.00023 | Key Management Subsystem Functional Acceptance Test Procedure                          | 1.0  | 17 Jul. 15 | Recommend BSV to review and revise some test expect result      | No Objection with comments |      |
| 1.10 | BSVS.00086 | Refund and Reload Machine Software Functional Acceptance Test Procedure                | 1.0  | 17 Jul. 15 | Recommend to recheck the Subsystem name in this document        | No Objection with comments |      |
| 1.11 | BSVB.00119 | Access Control Subsystem Functional Acceptance Test Procedure                          | 1.0  | 1 Jul. 15  | The document is fully detailed and comply with the requirements | No Objection               |      |

| No. | Doc. No.           | Description                 | Rev. | Date      | Document Review                                                                           |                            | Note |
|-----|--------------------|-----------------------------|------|-----------|-------------------------------------------------------------------------------------------|----------------------------|------|
|     |                    |                             |      |           | PMS Comments                                                                              | Comment Category           |      |
| 5   | Training Documents |                             |      |           |                                                                                           |                            |      |
| 1.1 | BSVS.00005         | Technology Transfer Program | 1.0  | 30 Aug 15 | Recommend to correct the document structure according to the standard document            | No Objection with comments |      |
|     |                    |                             | 2.0  | 29 Sep 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments         | No Objection               |      |
| 1.2 | BSVS.00020         | Training Program            | 1.0  | 30 Aug 15 | Recommend BSV to add the maintenance Source Code training course for maintenance training | No Objection with comments |      |
|     |                    |                             | 2.0  | 29 Sep 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments         | No Objection               |      |

| No. | Doc. No.   | Description      | Rev. | Date      | Document Review                                                                   |                            | Note |
|-----|------------|------------------|------|-----------|-----------------------------------------------------------------------------------|----------------------------|------|
|     |            |                  |      |           | PMS Comments                                                                      | Comment Category           |      |
| 6   |            |                  |      |           | User Documents                                                                    |                            |      |
| 1.1 | BSVB.00050 | Project Glossary | 1.0  | 3 Aug 15  | Recommend to recheck and fulfill all abbreviation and description                 | No Objection with comments |      |
|     |            |                  | 2.0  | 15 Sep 15 | BSV revise the document follow PMS comments and PMS doesn't have further comments | No Objection               |      |



## Appendix B     Table of the Establishment of the Central Clearing House Project's Incoming and Outgoing Documents

## Incoming Log

## The Establishment of the Central Clearing House (CCH)

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                        | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
|-----|-----------|------|-------------------------------|-----------------|--------------------------------------------------------------------|-----|---------------|---------------|-----------|--------------------|------|
|     |           |      |                               |                 |                                                                    |     |               | Hard copy     | Soft Copy |                    |      |
| 1   | IN0001    | BSV  | BSV.OTP.1000.P2500.09.03.2015 | 9 Mar 15        | Submission No.BSVB.00001 Rev1.0 NC Card Data Definition            | OTP | 9 Mar 15      | /             | /         | 11 May 15          |      |
| 2   | IN0002    | BSV  | BSV.OTP.1002.P2500.17.03.2015 | 17 Mar 15       | Submission No.BSVB.00002 Rev1.0 Submittal Schedule                 | OTP | 17 Mar 15     | /             | /         | 18 Mar 15          |      |
| 3   | IN0003    | BSV  | BSV.OTP.1003.P2500.17.03.2015 | 17 Mar 15       | Submission No.BSVB.00003 Rev1.0 Staff Organization Plan            | OTP | 17 Mar 15     | /             | /         | 18 Mar 15          |      |
| 4   | IN0004    | BSV  | BSV.OTP.1004.P2500.17.03.2015 | 17 Mar 15       | Submission No.BSVB.00004 Rev1.0 Outline Quality Plan               | OTP | 17 Mar 15     | /             | /         | 18 Mar 15          |      |
| 5   | IN0005    | BSV  | BSV.OTP.1005.P2500.17.03.2015 | 17 Mar 15       | Submission No.BSVB.00005 Rev1.0 Preliminary Test Plan              | OTP | 17 Mar 15     | /             | /         | 18 Mar 15          |      |
| 6   | IN0006    | BSV  | BSV.OTP.1006.P2500.17.03.2015 | 17 Mar 15       | Submission No.BSVB.00006 Rev1.0 Initial Work Program               | OTP | 17 Mar 15     | /             | /         | 18 Mar 15          |      |
| 7   | IN0007    | BSV  | BSV.OTP.1007.P2500.25.03.2015 | 25 Mar 15       | Submission of Monthly Progress Report-March 15                     | OTP | 27 Mar 15     | /             | /         | 30 Mar 15          |      |
| 8   | IN0008    | BSV  | BSV.OTP.1009.P2500.22.04.2015 | 22 Apr 15       | Submission No.BSVV.00001 Rev1.0 Technical and Network Architecture | OTP | 23 Apr 15     | /             | /         | 27 Apr 15          |      |

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| 9   | IN0009    | BSV  | BSV.OTP.1008.P2500.22.04.2015 | 22 Apr 15       | Submission No.BSVB.00010 Rev.1.0 System Architecture              | OTP | 23 Apr 15     | /             | /         | 27 Apr 15          |      |
| 10  | IN0010    | BSV  | BSV.OTP.1012.P2500.11.05.2015 | 11 May 15       | Submission of Monthly Progress Report-March 15 (Amended)          | OTP | 12 May 15     | /             |           | 12 May 15          |      |
| 11  | IN0011    | BSV  | BSV.OTP.1011.P2500.11.05.2015 | 11 May 15       | Submission No.BSVB.00008 Rev1.0 Coordinated Implementation Plan   | OTP | 12 May 15     | /             |           | 12 May 15          |      |
| 12  | IN0012    | BSV  | BSV.OTP.1013.P2500.15.05.2015 | 15 May 15       | Response to comments onBSVB.00003 Rev.1.0 Staff Organization Plan | OTP | 19 May 15     | /             | /         | 19 May 15          |      |
| 13  | IN0013    | BSV  | BSV.OTP.1014.P2500.15.05.2015 | 15 May 15       | Submission No.BSVB.00005 Rev 2.0 Preliminary Test Plan            | OTP | 19 May 15     | /             | /         | 19 May 15          |      |
| 14  | IN0014    | BSV  | BSV.OTP.1015.P2500.18.05.2015 | 15 May 15       | Submission No.BSVB.00006 Rev2.0 Initial Work Program              | OTP | 19 May 15     | /             | /         | 19 May 15          |      |
| 15  | IN0015    | BSV  | BSV.OTP.1010.P2500.18.05.2015 | 18 May 15       | Submission No.BSV.00002 Rev.1.0 System Security Architecture      | OTP | 19 May 15     | /             | /         | 19 May 15          |      |
| 16  | IN0016    | BSV  | BSV.OTP.1016.P2500.18.05.2015 | 18 May 15       | Submission No.BSVB.00002 Rev 2.0 Submittal Schedule               | OTP | 19 May 15     | /             | /         | 19 May 15          |      |
| 17  | IN0017    | BSV  | BSV.OTP.1017.P2500.25.05.2015 | 25 May 15       | Submission of Monthly Progress Report-April 15                    | OTP | 25 May 15     | /             | /         | 26 May 15          |      |
| 18  | IN0018    | BSV  | BSV.OTP.1018.P2500.25.05.2015 | 25 May 15       | Submission of Monthly Progress Report-May15                       | OTP | 25 May 15     | /             | /         | 26 May 15          |      |

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| 19  | IN0019    | BSV  | BSV.OTP.1020.P2500.28.05.2015 | 28 May 15       | Submission No.BSVB.00014 Rev. 1.0<br>Access Control Subsystem Software Requirement Specification  | OTP | 28 May 15     | /             | /         | 28 May 15          |      |
| 20  | IN0020    | BSV  | BSV.OTP.1021.P2500.28.05.2015 | 28 May 15       | Submission No.BSVB.00019 Rev.1.0<br>Device Management Subsystem Requirement Specification         | OTP | 28 May 15     | /             | /         | 28 May 15          |      |
| 21  | IN0021    | BSV  | BSV.OTP.1023.P2500.04.06.2015 | 4 Jun 15        | Submission No.BSV.00003 Rev.1.0<br>Financial Management Software Requirements Specification       | OTP | 5 Jun 15      | /             | /         | 8 Jun 15           |      |
| 22  | IN0022    | BSV  | BSV.OTP.1027.P2500.08.06.2015 | 8 Jun 15        | Submission No.BSV.00004 Rev.1.0<br>Issuer Subsystem Software Requirement Specification            | OTP | 9 Jun 15      | /             | /         | 9 Jun 15           |      |
| 23  | IN0023    | BSV  | BSV.OTP.1028.P2500.09.06.2015 | 9 Jun 15        | Submission No.BSVB.00017 Rev.1.0 Card<br>Inventory Management Subsystem Requirement Specification | OTP | 10 Jun 15     | /             | /         | 11 Jun 15          |      |
| 24  | IN0024    | BSV  | BSV.OTP.1029.P2500.10.06.2015 | 10 Jun 15       | Submission No.BSV.00014 Rev.1.0<br>Online Enquiry Software Requirement Specification              | OTP | 11 Jun 15     | /             | /         | 11 Jun 15          |      |
| 25  | IN0025    | BSV  | BSV.OTP.1030.P2500.10.06.2015 | 10 Jun 15       | Submission No.BSVB.00001 Rev.2.0 NC<br>Card Data Definition                                       | OTP | 11 Jun 15     | /             | /         | 11 Jun 15          |      |
| 26  | IN0026    | BSV  | BSV.OTP.1025.P2500.11.06.2015 | 11 Jun 15       | Submission No.BSVB.00011 Rev.1.0<br>Configuration Parameters                                      | OTP | 11 Jun 15     | /             | /         | 11 Jun 15          |      |

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| 27  | IN0027    | BSV  | BSV.OTP.1026.P2500.11.06.2015 | 11 Jun 15       | Submission No.BSVB.00013 Rev.1.0 NC Card Business Rule                                               | OTP | 11 Jun 15     | /             | /         | 11 Jun 15          |      |
| 28  | IN0028    | BSV  | BSV.OTP.1031.P2500.11.06.2015 | 11 Jun 15       | Submission No.BSVB.00012 Rev.1.0 Transaction Data Definition                                         | OTP | 11 Jun 15     | /             | /         | 11 Jun 15          |      |
| 29  | IN0029    | BSV  | BSV.OTP.1033.P2500.11.06.2015 | 11 Jun 15       | Submission No.BSV.00015 Rev.1.0 Online Enquiry Subsystem Interface Specification                     | OTP | 16 Jun 15     | /             | /         | 16 Jun 15          |      |
| 30  | IN0030    | BSV  | BSV.OTP.1032.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSV.00002 Rev.2.0 System Security Architecture                                         | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 31  | IN0031    | BSV  | BSV.OTP.1035.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00015 Rev.1.0 Action List Management Subsystem Software Requirement Specification | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 32  | IN0032    | BSV  | BSV.OTP.1037.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00023 Rev.1.0 System Management Subsystem Requirement Specification               | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 33  | IN0033    | BSV  | BSV.OTP.1038.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00016 Rev.1.0 Autoload Management Subsystem Software Requirement Specification    | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 34  | IN0034    | BSV  | BSV.OTP.1039.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00114 Rev.1.0 SP Website Software Requirement Specification                       | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |

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| 35  | IN0035    | BSV  | BSV.OTP.1040.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSV.00006 Rev.1.0 OTP to CCH Interface Specification                                          | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 36  | IN0036    | BSV  | BSV.OTP.1034.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00101 Rev.1.0 Configuration Data Management Subsystem Software Requirement Specification | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 37  | IN0037    | BSV  | BSV.OTP.1036.P2500.12.06.2015 | 12 Jun 15       | Submission No.BSVB.00022 Rev.1.0 Report Management Subsystem Software Requirement Specification             | OTP | 15 Jun 15     | /             | /         | 16 Jun 15          |      |
| 38  | IN0038    | BSV  | BSV.OTP.1041.P2500.16.06.2015 | 16 Jun 15       | Submission No.BSVB.00018 Rev.1.0 Communication Subsystem Software Requirement Specification                 | OTP | 17 Jun 15     | /             | /         | 16 Jun 15          |      |
| 39  | IN0039    | BSV  | BSV.OTP.1043.P2500.18.06.2015 | 18 Jun 15       | Submission No.BSV.00005 Rev.1.0 Cardholder Software Requirement Specification                               | OTP | 19 Jun 15     | /             | /         | 22 Jun 15          |      |
| 40  | IN0040    | BSV  | BSV.OTP.1049.P2500.25.06.2015 | 25 Jun 15       | Submission No.BSVB.00020 Rev.1.0 Host Security Management Software Requirement Specification                | OTP | 26 Jun 15     | /             | /         | 29 Jun 15          |      |
| 41  | IN0041    | BSV  | BSV.OTP.1048.P2500.25.06.2015 | 25 Jun 15       | Submission No.BSVB.00106 Rev.1.0 Cardholder Website Payment Gateway Interface Specification                 | OTP | 26 Jun 15     | /             | /         | 29 Jun 15          |      |

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| 42  | IN0042    | BSV  | BSV.OTP.1047.P2500.25.06.2015 | 25 Jun 15       | Submission No.BSVB.00105 Rev.1.0 Payment Gateway Software Requirement Specification           | OTP | 26 Jun 15     | /             | /         | 29 Jun 15          |      |
| 43  | IN0043    | BSV  | BSV.OTP.1046.P2500.25.06.2015 | 25 Jun 15       | Submission No.BSVB.00025 Rev.1.0 OTP CCH to Bank Interface Specification                      | OTP | 26 Jun 15     | /             | /         | 29 Jun 15          |      |
| 44  | IN0044    | BSV  | BSV.OTP.1045.P2500.25.06.2015 | 25 Jun 15       | Submission No.BSVB.00026 Rev.1.0 Equipment Initialization Interface File Specification        | OTP | 26 Jun 15     | /             | /         | 29 Jun 15          |      |
| 45  | IN0045    | BSV  | BSV.OTP.1050.P2500.01.07.2015 | 1 Jul 15        | Response to comments on BSW.00004 Rev.1.0 Issuer Subsystem Software Requirement Specification | OTP | 3 Jul 15      | /             | /         | 3 Jul 15           |      |
| 46  | IN0046    | BSV  | BSV.OTP.1051.P2500.02.07.2015 | 2 Jul 15        | Submission No.BSVB.00009 Rev.1.0 Quality Management Plan                                      | OTP | 3 Jul 15      | /             | /         | 3 Jul 15           |      |
| 47  | IN0047    | BSV  | BSV.OTP.1052.P2500.02.07.2015 | 2 Jul 15        | Submission No.BSVB.00004 Rev.2.0 Outline Quality Management Plan                              | OTP | 3 Jul 15      | /             | /         | 3 Jul 15           |      |
| 48  | IN0048    | BSV  | BSV.OTP.1053.P2500.06.07.2015 | 6 Jul 15        | Submission of Monthly Progress Report-June 2015                                               | OTP | 7 Jul 15      | /             | /         | 7 Jul 15           |      |
| 49  | IN0049    | BSV  | BSV.OTP.1055.P2500.09.07.2015 | 9 Jul 15        | Submission No.BSVB.00011 Rev.2.0 Configuration Parameters                                     | OTP | 10 Jul 15     | /             | /         | 10 Jul 15          |      |
| 50  | IN0050    | BSV  | BSV.OTP.1056.P2500.09.07.2015 | 9 Jul 15        | Submission No.BSVB.00012 Rev.2.0 Transaction Data Definition                                  | OTP | 10 Jul 15     | /             | /         | 10 Jul 15          |      |

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| 51  | IN0051    | BSV  | BSV.OTP.1057.P2500.09.07.2015 | 9 Jul 15        | Submission No.BSVB.00013 Rev.2.0 NC<br>Card Business Rules                                                                     | OTP | 10 Jul 15     | /             | /         | 10 Jul 15          |      |
| 52  | IN0052    | BSV  | BSV.OTP.1054.P2500.09.07.2015 | 9 Jul 15        | Submission No.BSVB.00013 Rev.3.0 NC<br>Card Data Definition                                                                    | OTP | 10 Jul 15     | /             | /         | 10 Jul 15          |      |
| 53  | IN0053    | BSV  | BSV.OTP.1060.P2500.13.07.2015 | 13 Jul 15       | Submission No.BSV.00015 Rev.2.0<br>Online Enquiry Subsystem Interface Specification                                            | OTP | 14 Jul 15     | /             | /         | 14 Jul 15          |      |
| 54  | IN0054    | BSV  | BSV.OTP.1015.P2500.13.07.2015 | 13 Jul 15       | Submission No.BSV.00002 Rev.3.0<br>System Security Architecture                                                                | OTP | 14 Jul 15     | /             | /         | 14 Jul 15          |      |
| 55  | IN0055    | BSV  | BSV.OTP.1059.P2500.13.07.2015 | 13 Jul 15       | Submission No.BSV.00006 Rev.2.0 OTP<br>CCH to Operator Interface Specification                                                 | OTP | 14 Jul 15     | /             | /         | 14 Jul 15          |      |
| 56  | IN0056    | BSV  | BSV.OTP.1071.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00019<br>Rev.1.0 Device Management Subsystem<br>Software Requirement Specification                | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 57  | IN0057    | BSV  | BSV.OTP.1070.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00018<br>Rev.1.0 Communication Subsystem<br>Software Requirement Specification                    | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 58  | IN0058    | BSV  | BSV.OTP.1069.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00101<br>Rev.1.0 Configuration Data Management<br>Subsystem Software Requirement<br>Specification | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |

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| 59  | IN0059    | BSV  | BSV.OTP.1068.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00022 Rev.1.0 Report Management Subsystem Software Requirement Specification   | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 60  | IN0060    | BSV  | BSV.OTP.1066.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00016 Rev.1.0 Autoload Management Subsystem Software Requirement Specification | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 61  | IN0061    | BSV  | BSV.OTP.1067.P2500.22.07.2015 | 22 Jul 15       | Response to comments on BSVB.00025 Rev.1.0 OTP CCH to Bank Interface Specification                          | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 62  | IN0062    | BSV  | BSV.OTP.1062.P2500.22.07.2015 | 22 Jul 15       | Submission No.BSVB.00023 Rev.2.0 System Management Subsystem Software Requirement Specification             | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 63  | IN0063    | BSV  | BSV.OTP.1061.P2500.22.07.2015 | 22 Jul 15       | Submission No.BSVB.00014 Rev.2.0 Access Control Subsystem Software Requirement Specification                | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 64  | IN0064    | BSV  | BSV.OTP.1063.P2500.22.07.2015 | 22 Jul 15       | Submission No.BSVB.00114 Rev.2.0 SP Website Software Requirement Specification                              | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 65  | IN0065    | BSV  | BSV.OTP.1064.P2500.22.07.2015 | 22 Jul 15       | Submission No.BSVB.00026 Rev.2.0 Equipment Initialization Interface File Specification                      | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |

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| 66  | IN0066    | BSV  | BSV.OTP.1065.P2500.22.07.2015 | 22 Jul 15       | Submission No.BSV.00016 Rev.1.0 Online Enquiry Subsystem Design Specification                                         | OTP | 22 Jul 15     | /             | /         | 22 Jul 15          |      |
| 67  | IN0067    | BSV  | BSV.OTP.1072.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSVS.00003 Rev.1.0 Card Initialization and Personalization Subsystem Software Requirement Specification | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 68  | IN0068    | BSV  | BSV.OTP.1073.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSVS.00004 Rev.1.0 Key Management Subsystem Software Requirement Specification                          | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 69  | IN0069    | BSV  | BSV.OTP.1074.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSVS.00069 Rev.1.0 Refund and Reload Machine Software Requirement Specification                         | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 70  | IN0070    | BSV  | BSV.OTP.1075.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSVS.00078 Rev.1.0 SAM Requirement Specification                                                        | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 71  | IN0071    | BSV  | BSV.OTP.1076.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSV.00001 Rev.2.0 System Architecture                                                                   | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 72  | IN0072    | BSV  | BSV.OTP.1077.P2500.27.07.2015 | 27 Jul 15       | Submission No.BSVB.00002 Rev.3.0 Submittal Schedule                                                                   | OTP | 28 Jul 15     | /             | /         | 28 Jul 15          |      |
| 73  | IN0073    | BSV  | BSV.OTP.1078.P2500.29.07.2015 | 29 Jul 15       | Submission No.BSV.00010 Rev.1.0 Issuer Subsystem Design Specification                                                 | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |

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| 74  | IN0074    | BSV  | BSV.OTP.1083.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSVB.00040 Rev.1.0 Action List Management Subsystem Design Specification                 | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 75  | IN0075    | BSV  | BSV.OTP.1079.P2500.29.07.2015 | 29 Jul 15       | Response to comments on BSV.00003 Rev.1.0 Financial Management Software Requirements Specification     | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 76  | IN0076    | BSV  | BSV.OTP.1085.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSVB.00044 Rev.1.0 Device Management Subsystem Software Design Specification             | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 77  | IN0077    | BSV  | BSV.OTP.1080.P2500.29.07.2015 | 29 Jul 15       | Submission No.BSV.00005 Rev.2.0 Cardholder Website Software Requirement Specification                  | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 78  | IN0078    | BSV  | BSV.OTP.1082.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSVB.00039 Rev.1.0 Access Control Subsystem Design Specification                         | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 79  | IN0079    | BSV  | BSV.OTP.1084.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSVB.00042 Rev.1.0 Card Inventory Management Subsystem Design Specification              | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 80  | IN0080    | BSV  | BSV.OTP.1086.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSVB.00116 Rev.1.0 Configuration Data Management Subsystem Software Design Specification | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |

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| 81  | IN0081    | BSV  | BSV.OTP.1081.P2500.31.07.2015 | 31 Jul 15       | Submission No.BSV.00009 Rev.1.0<br>Financial Management Subsystem<br>Software Design Specification | OTP | 3 Aug 15      | /             | /         | 4 Aug 15           |      |
| 82  | IN0082    | BSV  | BSV.OTP.1087.P2500.03.08.2015 | 3 Aug 15        | Monthly Progress Report - July 2015                                                                | OTP | 4 Aug 15      | /             | /         | 4 Aug 15           |      |
| 83  | IN0083    | BSV  | BSV.OTP.1089.P2500.06.08.2015 | 6 Aug 15        | Submission No.BSVB.00009 Rev.2.0<br>Quality Management Plan                                        | OTP | 7 Aug 15      | /             | /         | 10 Aug 15          |      |
| 84  | IN0084    | BSV  | BSV.OTP.1088.P2500.03.08.2015 | 3 Aug 15        | Submission No.BSVB.00050 Rev.1.0<br>Project Glossary                                               | OTP | 7 Aug 15      | /             | /         | 10 Aug 15          |      |
| 85  | IN0085    | BSV  | BSV.OTP.1090.P2500.06.08.2015 | 6 Aug 15        | Submission No.BSV.00011 Rev.1.0<br>Cardholder Website Software Design<br>Specification             | OTP | 11 Aug 15     | /             | /         | 13 Aug 15          |      |
| 86  | IN0086    | BSV  | BSV.OTP.1091.P2500.06.08.2015 | 6 Aug 15        | Submission No.BSV.00068 Rev.1.0<br>Overall Inspection and Test Plan                                | OTP | 11 Aug 15     | /             | /         | 13 Aug 15          |      |
| 87  | IN0087    | BSV  | BSV.OTP.1092.P2500.07.08.2015 | 7 Aug 15        | Submission No.BSVB.00104 Rev.1.0<br>System Security Architecture Design<br>Specification           | OTP | 11 Aug 15     | /             | /         | 13 Aug 15          |      |
| 88  | IN0088    | BSV  | BSV.OTP.1094.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00115 Rev.1.0 SP<br>Website Software Design Specification                       | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 89  | IN0089    | BSV  | BSV.OTP.1095.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00041 Rev.1.0<br>Autoload Management Subsystem Design<br>Specification          | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                       | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 90  | IN0090    | BSV  | BSV.OTP.1096.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00043 Rev.1.0 Communications Subsystem Software Design Specification           | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 91  | IN0091    | BSV  | BSV.OTP.1097.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00045 Rev.1.0 Host Security Management Subsystem Software Design Specification | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 92  | IN0092    | BSV  | BSV.OTP.1098.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00046 Rev.1.0 Report Management Subsystem Design Specification                 | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 93  | IN0093    | BSV  | BSV.OTP.1099.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00047 Rev.1.0 System Management Subsystem Software Design Specification        | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 94  | IN0094    | BSV  | BSV.OTP.1100.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00048 Rev.1.0 Central Clearing House Network Design                            | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 95  | IN0095    | BSV  | BSV.OTP.1101.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00049 Rev.1.0 Central Clearing House Server System Design                      | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 96  | IN0096    | BSV  | BSV.OTP.1102.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVB.00107 Rev.1.0 Payment Gateway Subsystem Design Specification                   | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                             | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 97  | IN0097    | BSV  | BSV.OTP.1105.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00010 Rev.1.0 Key Management Subsystem Design Specification                          | OTP | 14 Aug 15     | /             | /         | 17 Aug 15          |      |
| 98  | IN0098    | BSV  | BSV.OTP.1103.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00079 Rev.1.0 SAM Interface Specification                                            | OTP | 17 Aug 15     | /             | /         | 17 Aug 15          |      |
| 99  | IN0099    | BSV  | BSV.OTP.1104.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00009 Rev.1.0 Card Initialization and Personalization Subsystem Design Specification | OTP | 17 Aug 15     | /             | /         | 17 Aug 15          |      |
| 100 | IN0100    | BSV  | BSV.OTP.1108.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00083 Rev.1.0 SAM Design Specification                                               | OTP | 17 Aug 15     | /             | /         | 17 Aug 15          |      |
| 101 | IN0101    | BSV  | BSV.OTP.1106.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00011 Rev.1.0 Central Clearing House Equipment Rack Plan                             | OTP | 17 Aug 15     |               |           | 17 Aug 15          |      |
| 102 | IN0102    | BSV  | BSV.OTP.1109.P2500.13.08.2015 | 13 Aug 15       | Submission No.BSVS.00084 Rev.1.0 Refund and Reload Machine Software Design Specification                | OTP | 17 Aug 15     | /             | /         | 17 Aug 15          |      |
| 103 | IN0103    | BSV  | BSV.OTP.1115.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVW.00009 Rev.2.0 Financial Management Subsystem Software Design Specification           | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 104 | IN0104    | BSV  | BSV.OTP.1116.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVW.00010 Rev.2.0 Issuer Subsystem Design Specification                                  | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                                           | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 105 | IN0105    | BSV  | BSV.OTP.1117.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVS.00003 Rev.2.0 Card Initialization and Personalization Subsystem Software Requirement Specification | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 106 | IN0106    | BSV  | BSV.OTP.1118.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVS.00004 Rev.2.0 Key Management Subsystem Software Requirement Specification                          | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 107 | IN0107    | BSV  | BSV.OTP.1119.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVS.00069 Rev.2.0 Refund and Reload Machine Software Requirement Specification                         | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 108 | IN0108    | BSV  | BSV.OTP.1120.P2500.24.08.2015 | 24 Aug 15       | Submission No.BSVS.00078 Rev.2.0 SAM Requirement Specification                                                        | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 109 | IN0109    | BSV  | BSV.OTP.1121.P2500.26.08.2015 | 26 Aug 15       | Submission No.BSVW.00011 Rev.2.0 Cardholder Website Software Design Specification                                     | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 110 | IN0110    | BSV  | BSV.OTP.1122.P2500.26.08.2015 | 26 Aug 15       | Submission No.BSVS.00001 Rev.1.0 Hardware Bill of Materials                                                           | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 111 | IN0111    | BSV  | BSV.OTP.1123.P2500.26.08.2015 | 26 Aug 15       | Submission No.BSVS.00080 Rev.1.0 Third Party Software Bill of Materials                                               | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |
| 112 | IN0112    | BSV  | BSV.OTP.1124.P2500.26.08.2015 | 26 Aug 15       | Submission No.BSVS.00012 Rev.1.0 Procurement Plan                                                                     | OTP | 27 Aug 15     | /             | /         | 28 Aug 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                             | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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|     |           |      |                               |                 |                                                                                                         |     |               | Hard copy     | Soft Copy |                    |      |
| 113 | IN0113    | BSV  | BSV.OTP.1125.P2500.31.08.2015 | 31 Aug 15       | Submission No.BSVS.00005 Rev.1.0 Technology Transfer Program                                            | OTP | 31 Aug 15     | /             | /         | 2 Sep 15           |      |
| 114 | IN0114    | BSV  | BSV.OTP.1126.P2500.31.08.2015 | 31 Aug 15       | Submission No.BSVS.00002 Rev.1.0 Software Bill of Materials                                             | OTP | 31 Aug 15     | /             | /         | 2 Sep 15           |      |
| 115 | IN0115    | BSV  | BSV.OTP.1127.P2500.31.08.2015 | 31 Aug 15       | Submission No.BSVS.00020 Rev.1.0 Training Program                                                       | OTP | 31 Aug 15     | /             | /         | 2 Sep 15           |      |
| 116 | IN0116    | BSV  | BSV.OTP.1130.P2500.08.09.2015 | 8 Sep 15        | Submission of Detailed Design)                                                                          | OTP | 9 Sep 15      | /             | /         | 10 Sep 15          |      |
| 117 | IN0117    | BSV  | BSV.OTP.1128.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00079 Rev.2.0 SAM Interface Specification                                            | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 118 | IN0118    | BSV  | BSV.OTP.1131.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00009 Rev.2.0 Card Initialization and Personalization Subsystem Design Specification | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 119 | IN0119    | BSV  | BSV.OTP.1132.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00084 Rev.2.0 Refund and Reload Machine Software Design Specification                | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 120 | IN0120    | BSV  | BSV.OTP.1135.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVB.00104 Rev.2.0 System Security Architecture Design Specification                      | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 121 | IN0121    | BSV  | BSV.OTP.1134.P2500.10.09.2015 | 10 Sep 15       | Response to comments on BSVB.00107 Rev.1.0 Payment Gateway Subsystem Design Specification               | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                         | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 122 | IN0122    | BSV  | BSV.OTP.1133.P2500.10.09.2015 | 10 Sep 15       | Response to comments on BSVB.00042 Rev.1.0 Card Inventory Management Subsystem Design Specification | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 123 | IN0123    | BSV  | BSV.OTP.1136.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00083 Rev.2.0 SAM Design Specification                                           | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 124 | IN0124    | BSV  | BSV.OTP.1137.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00010 Rev.2.0 Key Management Subsystem Design Specification                      | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 125 | IN0125    | BSV  | BSV.OTP.1138.P2500.10.09.2015 | 10 Sep 15       | Submission No.BSVS.00011 Rev.2.0 Central Clearing House Equipment Rack Plan                         | OTP | 14 Sep 15     | /             | /         | 15 Sep 15          |      |
| 126 | IN0126    | BSV  | BSV.OTP.1139.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00039 Rev.2.0 Access Control Subsystem Design Specification                      | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 127 | IN0127    | BSV  | BSV.OTP.1140.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00040 Rev.2.0 Action List Management Subsystem Design Specification              | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 128 | IN0128    | BSV  | BSV.OTP.1141.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00041 Rev.2.0 Autoload Management Subsystem Design Specification                 | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                            | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 129 | IN0129    | BSV  | BSV.OTP.1142.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00116 Rev.2.0 Configuration Data Management Subsystem Software Design Specification | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 130 | IN0130    | BSV  | BSV.OTP.1143.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00044 Rev.2.0 Device Management Subsystem Software Design Specification             | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 131 | IN0131    | BSV  | BSV.OTP.1144.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00047 Rev.2.0 System Management Subsystem Software Design Specification             | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 132 | IN0132    | BSV  | BSV.OTP.1145.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00115 Rev.2.0 SP Website Software Design Specification                              | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 133 | IN0133    | BSV  | BSV.OTP.1146.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00050 Rev.2.0 Project Glossary                                                      | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 134 | IN0134    | BSV  | BSV.OTP.1147.P2500.14.09.2015 | 14 Sep 15       | Submission No.BSVB.00043 Rev.2.0 Communication Subsystem Software Design Specification                 | OTP | 15 Sep 15     | /             | /         | 15 Sep 15          |      |
| 135 | IN0135    | BSV  | BSV.OTP.1148.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVS.00012 Rev.2.0 Procurement Plan                                                      | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |
| 136 | IN0136    | BSV  | BSV.OTP.1149.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00020 Rev.2.0 Host Security Management Software Requirement Specification           | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                                 | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 137 | IN0137    | BSV  | BSV.OTP.1150.P2500.16.09.2015 | 16 Sep 15       | Response to comments on BSVB.00045 Rev.2.0 Host Security Management Subsystem Software Design Specification | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |
| 138 | IN0138    | BSV  | BSV.OTP.1151.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00046 Rev.2.0 Report Management Subsystem Design Specification                           | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |
| 139 | IN0139    | BSV  | BSV.OTP.1154.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00010 Rev.2.0 Technical and Network Architecture                                         | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |
| 140 | IN0140    | BSV  | BSV.OTP.1156.P2500.16.09.2015 | 16 Sep 15       | Request for Hardware change, The Establishment of the Central Clearing House (CCH)                          | OTP | 16 Sep 15     | /             | /         | 17 Sep 15          |      |
| 141 | IN0141    | BSV  | BSV.OTP.1157.P2500.18.09.2015 | 18 Sep 15       | Submission of Monthly Progress Report - August 2015                                                         | OTP | 21 Sep 15     | /             | /         | 21 Sep 15          |      |
| 142 | IN0142    | BSV  | BSV.OTP.1152.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00048 Rev.2.0 Central Clearing House Network Design                                      | OTP | 18 Sep 15     | /             | /         | 18 Sep 15          |      |
| 143 | IN0143    | BSV  | BSV.OTP.1153.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00049 Rev.2.0 Central Clearing House Server System Design                                | OTP | 18 Sep 15     | /             | /         | 18 Sep 15          |      |
| 144 | IN0144    | BSV  | BSV.OTP.1155.P2500.15.09.2015 | 15 Sep 15       | Submission No.BSVB.00068 Rev.2.0 Overall Inspection Test Plan                                               | OTP | 29 Sep 15     | /             | /         | 29 Sep 15          |      |

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| 145 | IN0145    | BSV  | BSV.OTP.1160.P2500.28.09.2015 | 28 Sep 15       | Submission No.BSVS.00005 Rev.2.0 Technology Transfer Program                                                   | OTP | 29 Sep 15     | /             | /         | 29 Sep 15          |      |
| 146 | IN0146    | BSV  | BSV.OTP.1161.P2500.28.09.2015 | 28 Sep 15       | Submission No.BSVS.00020 Rev.2.0 Training Program                                                              | OTP | 29 Sep 15     | /             | /         | 29 Sep 15          |      |
| 147 | IN0147    | BSV  | BSV.OTP.1159.P2500.29.09.2015 | 29 Sep 15       | Submission of Final Design                                                                                     | OTP | 29 Sep 15     | /             | /         | 30 Sep 15          |      |
| 148 | IN0148    | BSV  | BSV.OTP.1164.P2500.05.10.2015 | 5 Oct 15        | Response to comments on BSVS.00080 Rev.1.0 Third Party Software Bill of Materials                              | OTP | 6 Oct 15      | /             | /         | 6 Oct 15           |      |
| 149 | IN0149    | BSV  | BSV.OTP.1163.P2500.05.10.2015 | 5 Oct 15        | Submission No.BSVS.00002 Rev.2.0 Software Bill of Materials                                                    | OTP | 6 Oct 15      | /             | /         | 6 Oct 15           |      |
| 150 | IN0150    | BSV  | BSV.OTP.1166.P2500.13.10.2015 | 13 Oct 15       | Submission of Project Management Plan, Organization Plan, Submittal Schedule and Common Ticketing Final Design | OTP | 14 Oct 15     | /             | /         | 15 Oct 15          |      |
| 151 | IN0151    | BSV  | BSV.OTP.1167.P2500.15.10.2015 | 15 Oct 15       | Submission of Monthly Progress Report - September 2015                                                         | OTP |               | /             | /         |                    |      |
| 152 | IN0152    | BSV  | BSV.OTP.1169.P2500.10.11.2015 | 10 Nov 15       | Submission No.BSVB.00069 Rev.1.0 Functional Acceptance Test Plan                                               | OTP | 11 Nov 15     | /             | /         | 11 Nov 15          |      |
| 153 | IN0153    | BSV  | BSV.OTP.1168.P2500.04.11.2015 | 4 Nov 15        | Work Delivery Milestone#1 Approval of Design                                                                   | OTP | 4 Nov 57      | /             | /         | 25 Nov 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                               | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 154 | IN0154    | BSV  | BSV.OTP.1170.P2500.25.11.2015 | 25 Nov 15       | Request for Hardware change, The Establishment of the Central Clearing House (CCH)                        | OTP | 26 Nov 15     | /             | /         | 26 Nov 15          |      |
| 155 | IN0155    | BSV  | BSV.OTP.1171.P2500.01.12.2015 | 1 Dec 15        | Submission No.BSVB.00119 Rev.1.0 Access Control Functional Acceptance Test Procedure                      | OTP | 3 Dec 15      | /             | /         |                    |      |
| 156 | IN0156    | BSV  | BSV.OTP.1172.P2500.01.12.2015 | 1 Dec 15        | Submission No.BSVB.00076 Rev.1.0 Device Management Functional Acceptance Test Procedure                   | OTP | 3 Dec 15      | /             | /         |                    |      |
| 157 | IN0157    | BSV  | BSV.OTP.1158.P2500.30.11.2015 | 30 Nov 15       | Submission of the alternative solution to expand the Issuer ID                                            | OTP | 30 Nov 15     | /             | /         | 30 Nov 15          |      |
| 158 | IN0158    | BSV  | BSV.OTP.1177.P2500.08.12.2015 | 8 Dec 15        | Submission No.BSVB.00076 Rev.1.0 Action List Management Subsystem Functional Acceptance Test Procedure    | OTP | 11 Dec 15     | /             | /         | 14 Dec 15          |      |
| 159 | IN0159    | BSV  | BSV.OTP.1178.P2500.08.12.2015 | 8 Dec 15        | Submission No.BSVB.00073 Rev.1.0 Card Inventory Management Subsystem Functional Acceptance Test Procedure | OTP | 11 Dec 15     | /             | /         | 14 Dec 15          |      |
| 160 | IN0160    | BSV  | BSV.OTP.1179.P2500.09.12.2015 | 9 Dec 15        | Submission of Monthly Progress Report - October 2015                                                      | OTP | 11 Dec 15     | /             | /         | 14 Dec 15          |      |
| 161 | IN0161    | BSV  | BSV.OTP.1180.P2500.09.12.2015 | 9 Dec 15        | Submission of Monthly Progress Report - November 2015                                                     | OTP | 11 Dec 15     | /             | /         | 14 Dec 15          |      |

| No. | Scan Doc. | From | Submission No.                | Submission Date | Description                                                                                                             | To  | Received Date | Received Doc. |           | Instruction to PMS | Note |
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| 162 | IN0162    | BSV  | BSV.OTP.1181.P2500.14.12.2015 | 14 Dec 15       | Request for Common Ticketing Artwork for the Establishment of the Central Clearing House (CCH)                          | OTP | 15 Dec 15     | /             | /         | 17 Dec 15          |      |
| 163 | IN0163    | BSV  | BSV.OTP.1174.P2500.14.12.2015 | 14 Dec 15       | Submission No.BSVS.00023 Rev.1.0 Key Management Subsystem Functional Acceptance Test Procedure                          | OTP | 15 Dec 15     | /             | /         | 17 Dec 15          |      |
| 164 | IN0164    | BSV  | BSV.OTP.1175.P2500.14.12.2015 | 14 Dec 15       | Submission No.BSVS.00085 Rev.1.0 Reload and Refund Machine Software Functional Acceptance Test Procedure                | OTP | 15 Dec 15     | /             | /         | 17 Dec 15          |      |
| 165 | IN0165    | BSV  | BSV.OTP.1173.P2500.14.12.2015 | 14 Dec 15       | Submission No.BSVS.00022 Rev.1.0 Card Initialization and Personalization Subsystem Functional Acceptance Test Procedure | OTP | 15 Dec 15     | /             | /         | 17 Dec 15          |      |

## Outgoing Log

## The Establishment of the Central Clearing House (CCH)

| No. | Scan Doc | Letter No. | Date      | Description                                                                                    | From | To  | Outgoing document |        | Note   |
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|     |          |            |           |                                                                                                |      |     | By Hand           | e-Mail |        |
| 1   | out001   | 2015/004   | 17 Mar 15 | PMS consideration on NC Card Data Definition                                                   | PMS  | OTP | /                 | /      |        |
| 2   | out002   | 2015/005   | 3 Apr 15  | PMS consideration on CCH project documents                                                     | PMS  | OTP | /                 | /      |        |
| 3   | out003   | 2015/007   | 11 May 15 | PMS consideration on System Architecture Rev.1.0 and Technical Architecture Rev.1.0            | PMS  | OTP | /                 | /      | Cancel |
| 4   | out004   | 2015/010   | 27 May 15 | PMS consideration on Coordinated Implementation Plan Rev.1.0                                   | PMS  | OTP | /                 | /      |        |
| 5   | out005   | 2015/011   | 3 Jun 15  | PMS consideration on Initial Work Program Rev.2.0                                              | PMS  | OTP | /                 | /      |        |
| 6   | out006   | 2015/012   | 3 Jun 15  | PMS consideration on System Security Architecture Rev.1.0                                      | PMS  | OTP | /                 | /      |        |
| 7   | out007   | 2015/013   | 3 Jun 15  | PMS consideration on the response to PMS comments on Staff Organization Plan Rev.1.0           | PMS  | OTP | /                 | /      |        |
| 8   | out008   | 2015/014   | 8 Jun 15  | PMS consideration on Submittal Schedule Rev.2.0                                                | PMS  | OTP | /                 | /      |        |
| 9   | out009   | 2015/015   | 9 Jun 15  | PMS consideration on Preliminary Test Plan Rev.2.0                                             | PMS  | OTP | /                 | /      |        |
| 10  | out010   | 2015/016   | 12 Jun 15 | PMS consideration on Access Control Subsystem Software Requirement Specification Rev.1.0       | PMS  | OTP | /                 | /      |        |
| 11  | out011   | 2015/017   | 12 Jun 15 | PMS consideration on Data Management Subsystem Requirement Specification Rev.1.0               | PMS  | OTP | /                 | /      |        |
| 12  | out012   | 2015/018   | 24 Jun 15 | PMS consideration on Financial Management Software Subsystem Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |        |

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| 13  | out013   | 2015/019   | 24 Jun 15 | PMS consideration on Issuer Subsystem Software Requirement Specification Rev.1.0                    | PMS  | OTP | /                 | /      |      |
| 14  | out014   | 2015/020   | 24 Jun 15 | PMS consideration on Card Inventory Management Subsystem Software Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |
| 15  | out015   | 2015/021   | 25 Jun 15 | PMS consideration on NC Card Business Rules Rev.1.0                                                 | PMS  | OTP | /                 | /      |      |
| 16  | out016   | 2015/022   | 25 Jun 15 | PMS consideration on Configuration Parameters Rev.1.0                                               | PMS  | OTP | /                 | /      |      |
| 17  | out017   | 2015/023   | 25 Jun 15 | PMS consideration on NC Card Data Definition Rev.2.0                                                | PMS  | OTP | /                 | /      |      |
| 18  | out018   | 2015/024   | 25 Jun 15 | PMS consideration on Transaction Data Definition Rev.1.0                                            | PMS  | OTP | /                 | /      |      |
| 19  | out019   | 2015/025   | 25 Jun 15 | PMS consideration on Online Enquiry Software Requirement Specification Rev.1.0                      | PMS  | OTP | /                 | /      |      |
| 20  | out020   | 2015/026   | 30 Jun 15 | PMS consideration on Online Enquiry Subsystem Interface Specification Rev.1.0                       | PMS  | OTP | /                 | /      |      |
| 21  | out021   | 2015/027   | 30 Jun 15 | PMS consideration on System Security Architecture Rev.2.0                                           | PMS  | OTP | /                 | /      |      |
| 22  | out022   | 2015/028   | 30 Jun 15 | PMS consideration on Action List Management Subsystem Software Requirement Specification Rev.1.0    | PMS  | OTP | /                 | /      |      |
| 23  | out023   | 2015/029   | 30 Jun 15 | PMS consideration on System Management Subsystem Software Requirement Specification Rev.1.0         | PMS  | OTP | /                 | /      |      |
| 24  | out024   | 2015/030   | 30 Jun 15 | PMS consideration on Autobload Management Subsystem Software Requirement Specification Rev.1.0      | PMS  | OTP | /                 | /      |      |
| 25  | out025   | 2015/031   | 30 Jun 15 | PMS consideration on SP Website Software Requirement Specification Rev.1.0                          | PMS  | OTP | /                 | /      |      |
| 26  | out026   | 2015/032   | 30 Jun 15 | PMS consideration on OTP CCH to Operator Interface Specification Rev.1.0                            | PMS  | OTP | /                 | /      |      |

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| 27  | out027   | 2015/033   | 30 Jun 15 | PMS consideration on Configuration Data Management Subsystem Software Requirement Specification Rev.1.0          | PMS  | OTP | /                 | /      |      |
| 28  | out028   | 2015/034   | 30 Jun 15 | PMS consideration on Report Management Subsystem Software Requirement Specification Rev.1.0                      | PMS  | OTP | /                 | /      |      |
| 29  | out029   | 2015/035   | 1 Jul 15  | PMS consideration on Communication Subsystem Software Requirement Specification Rev.1.0                          | PMS  | OTP | /                 | /      |      |
| 30  | out030   | 2015/036   | 1 Jul 15  | PMS consideration on Cardholder Software Requirement Specification Rev.1.0                                       | PMS  | OTP | /                 | /      |      |
| 31  | out031   | 2015/038   | 7 Jul 15  | PMS consideration on Cardholder Website Payment Gateway Interface Specification Rev.1.0                          | PMS  | OTP | /                 | /      |      |
| 32  | out032   | 2015/039   | 7 Jul 15  | PMS consideration on Payment Gateway Software Requirement Specification Rev.1.0                                  | PMS  | OTP | /                 | /      |      |
| 33  | out033   | 2015/040   | 7 Jul 15  | PMS consideration on OTP CCH to Bank Interface Specification Rev.1.0                                             | PMS  | OTP | /                 | /      |      |
| 34  | out034   | 2015/041   | 7 Jul 15  | PMS consideration on Equipment Initialization Interface File Specification Rev.1.0                               | PMS  | OTP | /                 | /      |      |
| 35  | out035   | 2015/042   | 7 Jul 15  | PMS consideration on Host Security Management Software Requirement Specification Rev.1.0                         | PMS  | OTP | /                 | /      |      |
| 36  | out036   | 2015/043   | 16 Jul 15 | PMS consideration on the response to PMS comments on Issuer Subsystem Software Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |
| 37  | out037   | 2015/044   | 16 Jul 15 | PMS consideration on Quality Management Plan Rev.1.0                                                             | PMS  | OTP | /                 | /      |      |
| 38  | out038   | 2015/045   | 16 Jul 15 | PMS consideration on Outline Quality Plan Rev.2.0                                                                | PMS  | OTP | /                 | /      |      |
| 39  | out039   | 2015/046   | 20 Jul 15 | PMS consideration on NC Card Data Definition Rev.3.0                                                             | PMS  | OTP | /                 | /      |      |
| 40  | out040   | 2015/047   | 20 Jul 15 | PMS consideration on Configuration Parameters Rev.2.0                                                            | PMS  | OTP | /                 | /      |      |

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| 41  | out041   | 2015/048   | 20 Jul 15 | PMS consideration on Transaction Data Definition Rev.2.0                                                                                | PMS  | OTP | /                 | /      |      |
| 42  | out042   | 2015/049   | 20 Jul 15 | PMS consideration on NC Card Business Rules Rev.2.0                                                                                     | PMS  | OTP | /                 | /      |      |
| 43  | out043   | 2015/050   | 23 Jul 15 | PMS consideration on System Architecture Rev.1.0                                                                                        | PMS  | OTP | /                 | /      |      |
| 44  | out044   | 2015/051   | 23 Jul 15 | PMS consideration on Technical and Network Architecture Rev.1.0                                                                         | PMS  | OTP | /                 | /      |      |
| 45  | out045   | 2015/052   | 23 Jul 15 | PMS consideration on System Security Architecture Rev.3.0                                                                               | PMS  | OTP | /                 | /      |      |
| 46  | out046   | 2015/053   | 23 Jul 15 | PMS consideration on Online Enquiry Subsystem Interface Specification Rev.2.0                                                           | PMS  | OTP | /                 | /      |      |
| 47  | out047   | 2015/054   | 23 Jul 15 | PMS consideration on OTP CCH to Operator Interface Specification Rev.2.0                                                                | PMS  | OTP | /                 | /      |      |
| 48  | out048   | 2015/055   | 29 Jul 15 | PMS consideration on SP Website Software Requirement Specification Rev.2.0                                                              | PMS  | OTP | /                 | /      |      |
| 49  | out049   | 2015/056   | 29 Jul 15 | PMS consideration on Equipment Initialization Interface File Specification Rev.2.0                                                      | PMS  | OTP | /                 | /      |      |
| 50  | out050   | 2015/057   | 29 Jul 15 | PMS consideration on System Management Subsystem Software Requirement Specification Rev.2.0                                             | PMS  | OTP | /                 | /      |      |
| 51  | out051   | 2015/058   | 29 Jul 15 | PMS consideration on Access Control Subsystem Software Requirement Specification Rev.2.0                                                | PMS  | OTP | /                 | /      |      |
| 52  | out052   | 2015/059   | 29 Jul 15 | PMS consideration on Online Enquiry Subsystem Design Specification Rev.1.0                                                              | PMS  | OTP | /                 | /      |      |
| 53  | out053   | 2015/060   | 29 Jul 15 | PMS consideration on the response to PMS comments on Configuration Data Management Subsystem Software Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |

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| 54  | out054   | 2015/061   | 29 Jul 15 | PMS consideration on the response to PMS comments on OTP CCH to Bank Interface Specification Rev.1.0                          | PMS  | OTP | /                 | /      |      |
| 55  | out055   | 2015/062   | 29 Jul 15 | PMS consideration on the response to PMS comments on Report Management Subsystem Software Requirement Specification Rev.1.0   | PMS  | OTP | /                 | /      |      |
| 56  | out056   | 2015/063   | 29 Jul 15 | PMS consideration on the response to PMS comments on Device Management Subsystem Requirement Specification Rev.1.0            | PMS  | OTP | /                 | /      |      |
| 57  | out057   | 2015/064   | 29 Jul 15 | PMS consideration on the response to PMS comments on Communication Subsystem Software Requirement Specification Rev.1.0       | PMS  | OTP | /                 | /      |      |
| 58  | out058   | 2015/065   | 29 Jul 15 | PMS consideration on the response to PMS comments on Autoload Management Subsystem Software Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |
| 59  | out059   | 2015/066   | 8 Aug 15  | PMS consideration on Card Initialization and Personalization Subsystem Software Requirement Specification Rev.1.0             | PMS  | OTP | /                 | /      |      |
| 60  | out060   | 2015/067   | 8 Aug 15  | PMS consideration on Key Management Subsystem Software Requirement Specification Rev.1.0                                      | PMS  | OTP | /                 | /      |      |
| 61  | out061   | 2015/068   | 8 Aug 15  | PMS consideration on Refund and Reload Machine Software Requirement Specification Rev.1.0                                     | PMS  | OTP | /                 | /      |      |
| 62  | out062   | 2015/069   | 8 Aug 15  | PMS consideration on SAM requirement Specification Rev.1.0                                                                    | PMS  | OTP | /                 | /      |      |
| 63  | out063   | 2015/070   | 8 Aug 15  | PMS consideration on Submittal Schedule Rev.3.0                                                                               | PMS  | OTP | /                 | /      |      |
| 64  | out064   | 2015/071   | 8 Aug 15  | PMS consideration on System Architecture Rev.2.0                                                                              | PMS  | OTP | /                 | /      |      |
| 65  | out065   | 2015/074   | 14 Aug 15 | PMS Suggest OTP to publish the Common Ticketing Standard                                                                      | PMS  | OTP | /                 | /      |      |

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| 66  | out066   | 2015/075   | 14 Aug 15 | PMS consideration on Issuer Subsystem Design Specification Rev.1.0                                                   | PMS  | OTP | /                 | /      |      |
| 67  | out067   | 2015/076   | 14 Aug 15 | PMS consideration on Action List Management Subsystem Design Specification Rev.1.0                                   | PMS  | OTP | /                 | /      |      |
| 68  | out068   | 2015/077   | 14 Aug 15 | PMS consideration on the response to PMS comments on Financial Management Software Requirement Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |
| 69  | out069   | 2015/078   | 14 Aug 15 | PMS consideration on Device Management Subsystem Software Design Specification Rev.1.0                               | PMS  | OTP | /                 | /      |      |
| 70  | out070   | 2015/079   | 14 Aug 15 | PMS consideration on Cardholder Website Software Requirement Specification Rev.2.0                                   | PMS  | OTP | /                 | /      |      |
| 71  | out071   | 2015/080   | 14 Aug 15 | PMS consideration on Access Control Subsystem Design Specification Rev.1.0                                           | PMS  | OTP | /                 | /      |      |
| 72  | out072   | 2015/081   | 14 Aug 15 | PMS consideration on Card Inventory Management Subsystem Design Specification Rev.1.0                                | PMS  | OTP | /                 | /      |      |
| 73  | out073   | 2015/082   | 14 Aug 15 | PMS consideration on Configuration Data Management Subsystem Software Design Specification Rev.1.0                   | PMS  | OTP | /                 | /      |      |
| 74  | out074   | 2015/083   | 14 Aug 15 | PMS consideration on Financial Management Subsystem Software Design Specification Rev.1.0                            | PMS  | OTP | /                 | /      |      |
| 75  | out075   | 2015/084   | 17 Aug 15 | PMS consideration on Quality Management Plan Rev.2.0                                                                 | PMS  | OTP | /                 | /      |      |
| 76  | out076   | 2015/085   | 17 Aug 15 | PMS consideration on Project Glossary Rev.1.0                                                                        | PMS  | OTP | /                 | /      |      |
| 77  | out077   | 2015/086   | 24 Aug 15 | PMS consideration on SP Website Subsystem Design Specification Rev.1.0                                               | PMS  | OTP | /                 | /      |      |
| 78  | out078   | 2015/087   | 24 Aug 15 | PMS consideration on Overall inspection and Test Plan Rev.1.0                                                        | PMS  | OTP | /                 | /      |      |

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| 79  | out079   | 2015/088   | 24 Aug 15 | PMS consideration on Cardholder Website Software Design Specification Rev.1.0                       | PMS  | OTP | /                 | /      |      |
| 80  | out080   | 2015/089   | 24 Aug 15 | PMS consideration on System Security Architecture Design Specification Rev.1.0                      | PMS  | OTP | /                 | /      |      |
| 81  | out081   | 2015/090   | 26 Aug 15 | PMS consideration on Key Management Subsystem Design Specification Rev.1.0                          | PMS  | OTP | /                 | /      |      |
| 82  | out082   | 2015/091   | 26 Aug 15 | PMS consideration on Payment Gateway Subsystem Design Specification Rev.1.0                         | PMS  | OTP | /                 | /      |      |
| 83  | out083   | 2015/092   | 26 Aug 15 | PMS consideration on Central Clearing House Server System Design Rev.1.0                            | PMS  | OTP | /                 | /      |      |
| 84  | out084   | 2015/093   | 26 Aug 15 | PMS consideration on Central Clearing House Network Design Rev.1.0                                  | PMS  | OTP | /                 | /      |      |
| 85  | out085   | 2015/094   | 26 Aug 15 | PMS consideration on System Management Subsystem Software Design Specification Rev.1.0              | PMS  | OTP | /                 | /      |      |
| 86  | out086   | 2015/095   | 26 Aug 15 | PMS consideration on Host Security Management Subsystem Software Design Specification Rev.1.0       | PMS  | OTP | /                 | /      |      |
| 87  | out087   | 2015/096   | 26 Aug 15 | PMS consideration on Communication Subsystem Software Design Specification Rev.1.0                  | PMS  | OTP | /                 | /      |      |
| 88  | out088   | 2015/097   | 26 Aug 15 | PMS consideration on Autoload Management Subsystem Design Specification Rev.1.0                     | PMS  | OTP | /                 | /      |      |
| 89  | out089   | 2015/098   | 31 Aug 15 | PMS consideration on Report Management Subsystem Design Specification Rev.1.0                       | PMS  | OTP | /                 | /      |      |
| 90  | out090   | 2015/099   | 31 Aug 15 | PMS consideration on Card Initialization and Personalization Subsystem Design Specification Rev.1.0 | PMS  | OTP | /                 | /      |      |

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| 91  | out091   | 2015/100   | 31 Aug 15 | PMS consideration on SAM Interface Specification Rev.1.0                                                          | PMS  | OTP | /                 | /      |      |
| 92  | out092   | 2015/101   | 31 Aug 15 | PMS consideration on SAM Design Specification Rev.1.0                                                             | PMS  | OTP | /                 | /      |      |
| 93  | out093   | 2015/102   | 31 Aug 15 | PMS consideration on Refund and Reload Machine Software Design Specification Rev.1.0                              | PMS  | OTP | /                 | /      |      |
| 94  | out094   | 2015/103   | 9 Sep 15  | PMS consideration on Refund and Reload Machine Software Requirement Specification Rev.2.0                         | PMS  | OTP | /                 | /      |      |
| 95  | out095   | 2015/104   | 9 Sep 15  | PMS consideration on Key Management Subsystem Software Requirement Specification Rev.2.0                          | PMS  | OTP | /                 | /      |      |
| 96  | out096   | 2015/105   | 9 Sep 15  | PMS consideration on Card Initialization and Personalization Subsystem Software Requirement Specification Rev.2.0 | PMS  | OTP | /                 | /      |      |
| 97  | out097   | 2015/106   | 9 Sep 15  | PMS consideration on Issuer Subsystem Design Specification Rev.2.0                                                | PMS  | OTP | /                 | /      |      |
| 98  | out098   | 2015/107   | 9 Sep 15  | PMS consideration on Financial Management Subsystem Software Design Specification Rev.2.0                         | PMS  | OTP | /                 | /      |      |
| 99  | out099   | 2015/108   | 9 Sep 15  | PMS consideration on Central Clearing House Rack Plan Rev.1.0                                                     | PMS  | OTP | /                 | /      |      |
| 100 | out100   | 2015/109   | 10 Sep 15 | PMS consideration on SAM Requirement Specification Rev.2.0                                                        | PMS  | OTP | /                 | /      |      |
| 101 | out101   | 2015/110   | 11 Sep 15 | PMS consideration on Procurement Plan Rev.1.0                                                                     | PMS  | OTP | /                 | /      |      |
| 102 | out102   | 2015/111   | 11 Sep 15 | PMS consideration on Third Party Software Bill of Materials Rev.1.0                                               | PMS  | OTP | /                 | /      |      |
| 103 | out103   | 2015/112   | 17 Sep 15 | PMS consideration on Technology Transfer Program Rev.1.0                                                          | PMS  | OTP | /                 | /      |      |

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| 104 | out104   | 2015/113   | 17 Sep 15 | PMS consideration on CCH Software Bill of Materials Rev.1.0                             | PMS  | OTP | /                 | /      |      |
| 105 | out105   | 2015/114   | 17 Sep 15 | PMS consideration on Training Program Rev.1.0                                           | PMS  | OTP | /                 | /      |      |
| 106 | out106   | 2015/115   | 17 Sep 15 | PMS consideration on Payment Gateway Subsystem Design Specification Rev.1.0             | PMS  | OTP | /                 | /      |      |
| 107 | out107   | 2015/116   | 17 Sep 15 | PMS consideration on Card Inventory Management Subsystem Design Specification Rev.1.0   | PMS  | OTP | /                 | /      |      |
| 108 | out108   | 2015/117   | 17 Sep 15 | PMS consideration on request for CCH hardware change                                    | PMS  | OTP | /                 | /      |      |
| 109 | out109   | 2015/118   | 18 Sep 15 | PMS consideration on Hardware Bill of Materials Rev.1.0                                 | PMS  | OTP | /                 | /      |      |
| 110 | out110   | 2015/119   | 24 Sep 15 | PMS consideration on Central Clearing House Network Design Rev. 2.0                     | PMS  | OTP | /                 | /      |      |
| 111 | out111   | 2015/120   | 24 Sep 15 | PMS consideration on Central Clearing House Server System Design Rev. 2.0               | PMS  | OTP | /                 | /      |      |
| 112 | out112   | 2015/121   | 24 Sep 15 | PMS consideration on Cardholder Website Software Design Specification Rev. 2.0          | PMS  | OTP | /                 | /      |      |
| 113 | out113   | 2015/122   | 24 Sep 15 | PMS consideration on SP Website Subsystem Software Design Specification Rev. 2.0        | PMS  | OTP | /                 | /      |      |
| 114 | out114   | 2015/123   | 24 Sep 15 | PMS consideration on Report Management Subsystem Design Specification Rev. 2.0          | PMS  | OTP | /                 | /      |      |
| 115 | out115   | 2015/124   | 24 Sep 15 | PMS consideration on Key Management Subsystem Design Specification Rev. 2.0             | PMS  | OTP | /                 | /      |      |
| 116 | out116   | 2015/125   | 24 Sep 15 | PMS consideration on System Security Architecture Design Specification Rev. 2.0         | PMS  | OTP | /                 | /      |      |
| 117 | out117   | 2015/126   | 24 Sep 15 | PMS consideration on Communication Subsystem Software Design Specification Rev. 2.0     | PMS  | OTP | /                 | /      |      |
| 118 | out118   | 2015/127   | 24 Sep 15 | PMS consideration on Device Management Subsystem Software Design Specification Rev. 2.0 | PMS  | OTP | /                 | /      |      |

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| 119 | out119   | 2015/128   | 24 Sep 15 | PMS consideration on System Management Subsystem Software Design Specification Rev. 2.0                                        | PMS  | OTP | /                 | /      |      |
| 120 | out120   | 2015/129   | 24 Sep 15 | PMS consideration on Project Glossary Rev. 2.0                                                                                 | PMS  | OTP | /                 | /      |      |
| 121 | out121   | 2015/130   | 24 Sep 15 | PMS consideration on Configuration Data Management Subsystem Software Design Specification Rev. 2.0                            | PMS  | OTP | /                 | /      |      |
| 122 | out122   | 2015/131   | 24 Sep 15 | PMS consideration on Card Initialization and Personalization Subsystem Design Specification Rev. 2.0                           | PMS  | OTP | /                 | /      |      |
| 123 | out123   | 2015/132   | 24 Sep 15 | PMS consideration on Refund and Reload Machine Software Design Specification Rev. 2.0                                          | PMS  | OTP | /                 | /      |      |
| 124 | out124   | 2015/133   | 24 Sep 15 | PMS consideration on Central Clearing House Equipment Rack Plan Rev. 2.0                                                       | PMS  | OTP | /                 | /      |      |
| 125 | out125   | 2015/134   | 24 Sep 15 | PMS consideration on SAM Interface Specification Rev. 2.0                                                                      | PMS  | OTP | /                 | /      |      |
| 126 | out126   | 2015/135   | 24 Sep 15 | PMS consideration on SAM Design Specification Rev. 2.0                                                                         | PMS  | OTP | /                 | /      |      |
| 127 | out127   | 2015/136   | 24 Sep 15 | PMS consideration on Technical and Network Architecture Rev. 2.0                                                               | PMS  | OTP | /                 | /      |      |
| 128 | out128   | 2015/138   | 24 Sep 15 | PMS consideration on the response to PMS comments on Host Security Management Subsystem Software Design Specification Rev. 2.0 | PMS  | OTP | /                 | /      |      |
| 129 | out129   | 2015/139   | 24 Sep 15 | PMS consideration on Access Control Subsystem Design Specification Rev. 2.0                                                    | PMS  | OTP | /                 | /      |      |
| 130 | out130   | 2015/140   | 24 Sep 15 | PMS consideration on Action List Management Subsystem Design Specification Rev. 2.0                                            | PMS  | OTP | /                 | /      |      |
| 131 | out131   | 2015/141   | 24 Sep 15 | PMS consideration on Autoload Management Subsystem Design Specification Rev. 2.0                                               | PMS  | OTP | /                 | /      |      |
| 132 | out132   | 2015/142   | 25 Sep 15 | PMS consideration on Common Ticketing and CCH Detail Design Document                                                           | PMS  | OTP | /                 | /      |      |
| 133 | out133   | 2015/143   | 28 Sep 15 | PMS consideration on Procurement Plan Rev. 2.0                                                                                 | PMS  | OTP | /                 | /      |      |
| 134 | out134   | 2015/144   | 6 Oct 15  | PMS consideration on Final Design Document                                                                                     | PMS  | OTP | /                 | /      |      |

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| 135 | out135   | 2015/146   | 8 Oct 15  | PMS consideration on Overall Inspection and Test Plan Rev. 2.0                                                            | PMS  | OTP | /                 | /      |      |
| 136 | out136   | 2015/147   | 8 Oct 15  | PMS consideration on Training Program Rev. 2.0                                                                            | PMS  | OTP | /                 | /      |      |
| 137 | out137   | 2015/148   | 8 Oct 15  | PMS consideration on Technology Transfer Program Rev. 2.0                                                                 | PMS  | OTP | /                 | /      |      |
| 138 | out138   | 2015/152   | 16 Oct 15 | PMS consideration on CCH Software Bill of Material Rev. 2.0                                                               | PMS  | OTP | /                 | /      |      |
| 139 | out139   | 2015/154   | 30 Oct 15 | PMS consideration on Project Management Plan, Organization Plan, Submittal Schedule and Common Ticketing Design Documents | PMS  | OTP | /                 | /      |      |
| 140 | out140   | 2015/157   | 19 Nov 15 | PMS consideration on BSVB.00069 Rev. 1.0 Functional Acceptance Test Plan                                                  | PMS  | OTP | /                 | /      |      |
| 141 | out141   | 2015/158   | 25 Nov 15 | PMS consideration on the documentation of Work Delivery Milestone#1 Approval of Design                                    | PMS  | OTP | /                 | /      |      |
| 142 | out142   | 2015/159   | 26 Nov 15 | PMS consideration on CCH hardware change                                                                                  | PMS  | OTP | /                 | /      |      |
| 143 | out143   | 2015/160   | 30 Nov 15 | PMS consideration on the alternative solution to expand the Issuer ID                                                     | PMS  | OTP | /                 | /      |      |
| 144 | out144   | 2015/161   | 21 Dec 15 | PMS consideration on Device Management Functional Acceptance Test Procedure Rev.1.0                                       | PMS  | OTP | /                 | /      |      |
| 145 | out145   | 2015/162   | 21 Dec 15 | PMS consideration on Access Control Functional Acceptance Test Procedure Rev.1.0                                          | PMS  | OTP | /                 | /      |      |
| 146 | out146   | 2015/163   | 30 Dec 15 | PMS consideration on Card Initialization and Personalization Subsystem Functional Acceptance Test Procedure Rev.1.0       | PMS  | OTP | /                 | /      |      |
| 147 | out147   | 2015/164   | 30 Dec 15 | PMS consideration on Reload and Refund Machine Software Functional Acceptance Test Procedure Rev.1.0                      | PMS  | OTP | /                 | /      |      |
| 148 | out148   | 2015/165   | 30 Dec 15 | PMS consideration on Key Management Subsystem Functional Acceptance Test Procedure Rev.1.0                                | PMS  | OTP | /                 | /      |      |
| 149 | out149   | 2015/166   | 30 Dec 15 | PMS consideration on Card Inventory Management Subsystem Functional Acceptance Test Procedure Rev.1.0                     | PMS  | OTP | /                 | /      |      |

| No. | Scan Doc | Letter No. | Date      | Description                                                                                        | From | To  | Outgoing document |        | Note |
|-----|----------|------------|-----------|----------------------------------------------------------------------------------------------------|------|-----|-------------------|--------|------|
| 150 | out150   | 2015/167   | 30 Dec 15 | PMS consideration on Action List Management Subsystem Functional Acceptance Test Procedure Rev.1.0 | PMS  | OTP | By Hand           | e-Mail | /    |



