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| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 1 (15) |
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| Customer Contract Number C030588 | Customer Contract Start/Finish Dates 21-Jan-2009 to 31-Dec-2010 | | |

Concept of Operations

C030588 CVII Task 3

Task 3 builds on the base CVII infrastructure developed in Task 2 providing a driver credentials verification application.

| | |
|-------------------------|-------------|
| Responsible | Tom Richter |
| Established Date | 22-Feb-2010 |
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|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 2 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

Contents

| | | |
|-------|--|----|
| 1 | General Information | 3 |
| 1.1 | Document Contacts | 3 |
| 1.2 | Revision History | 3 |
| 1.3 | Reference Documents | 3 |
| 1.4 | Abbreviations | 4 |
| 1.5 | Requirement Identifier..... | 4 |
| 2 | Task 3 Concept..... | 5 |
| 2.1 | Background..... | 5 |
| 2.2 | Objectives | 5 |
| 2.3 | System Overview | 6 |
| 2.4 | Operational Scenarios | 7 |
| 2.4.1 | Driver Credentials Validation Service Registration | 7 |
| 2.4.2 | Vehicle Startup..... | 8 |
| 3 | Task 3 Requirements..... | 11 |
| 3.1 | General Requirements..... | 11 |
| 3.2 | RSE Driver Credentials Validation Service | 11 |
| 3.2.1 | GBS Simulation | 12 |
| 3.3 | TGW Driver Credentials Validation Application..... | 13 |
| 3.4 | DMCU Driver Credentials Validation Application | 14 |

VOLVO

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 3 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

1 General Information

This document describes the concept of operations and requirements for Task 3 of the NYSDOT CVII Project.

1.1 Document Contacts

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1.2 Revision History

| Issue | Date | Author | Changes |
|-------|-------------|--------------|--|
| 1.0 | 21 May 2010 | Mike Siebert | Initial |
| 1.1 | 11 Jun 2010 | Mike Siebert | Incorporated review comments from NYS. |

1.3 Reference Documents

- [1] Contract #C030588 – PIN: CC95.07.121
Commercial Vehicle Infrastructure Integration
New York State – Department of Transportation
- [2] 6980-02821-01-02 C030588 CVII Program Plan
Volvo Technology – Tom Richter
Issue 2.1 – 15 Sep 2009
- [3] NYS CVII DSRC Message Set
Southwest Research Institute – Mike Brown
Issue 1.0 – 09 Oct 2009
[Based on SAE J2735 DSRC Message Set Dictionary]

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 4 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
| Customer Company New York State DOT | Customer Name Rick McDonough | | Customer Phone +1 (518) 457-5871 |
| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

- [4] DMCU/Vehicle Gateway Interface Definition
Southwest Research Institute – Mike Brown
Issue 1.0.0 – 09 Oct 2009
- [5] 6980-02821-01-04 State-of-the-Art Review on Information and Warning Strategies
Volvo Technology – Paul Piamonte
Issue 1.0 – 09 Oct 2009

1.4 Abbreviations

| | |
|---------|--|
| CDL | Commercial Drivers License |
| ConOps | Concept of Operations |
| CVII | Commercial Vehicle to Infrastructure Integration |
| DOT | Department of Transportation |
| DMCU | 5.9 GHz DSRC Mobile Communications Unit |
| DSRC | Dedicated Short-Range Communications |
| ECU | Electronic Control Unit |
| HVI | Human Vehicle Interface |
| IP | Internet Protocol |
| N/A | Not Applicable |
| NYS | New York State |
| NYS DOT | New York State Department of Transportation |
| PIN | Personal Identification Number |
| RSE | Roadside Equipment |
| SAE | Society of Automotive Engineers |
| TGW | Volvo Telematics GateWay |
| TWIC | Transportation Workers Identification Card |
| VII | Vehicle to Infrastructure Integration |
| VTEC | Volvo Technology |

1.5 Requirement Identifier

Req TASK3-001/1.0: Requirement Identifier

The requirement identifier for this specification shall be TASK3.

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 5 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

2 Task 3 Concept

2.1 Background

The overall scope of the NYSDOT CVII Project can be found in References [1] and [2].

Task 3 builds on the base CVII infrastructure, developed in Task 2, to create a Driver Credentials Validation Application.

2.2 Objectives

The objectives of Task 3 are to develop and demonstrate a CVII application which requires a commercial vehicle driver's credentials to be validated prior to allowing a parked vehicle to be started.

The specific activities required for Task 3 are:

- Research commercial vehicle driver credentialing
 - Evaluate the current and potential future applications of TWIC cards for commercial vehicle credentialing
 - Identify other potential approaches to driver identification currently being discussed, including any new technological developments and government initiatives
 - Select a feasible solution for implementation in the Driver Credentials Validation Application
- Develop a driver credentials validation application
 - Define an extension to the SAE J2735 DSRC Message Set Dictionary, used in existing IntelliDriveSM applications, which is compatible with existing message set definitions
 - Provide an HVI consistent with the commercial vehicle environment
 - Collect commercial vehicle driver's credentials
 - Provide a simulated government validation application
 - Support vehicle immobilization
 - Complete acceptance test of the application

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|---|--|--|--|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 6 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

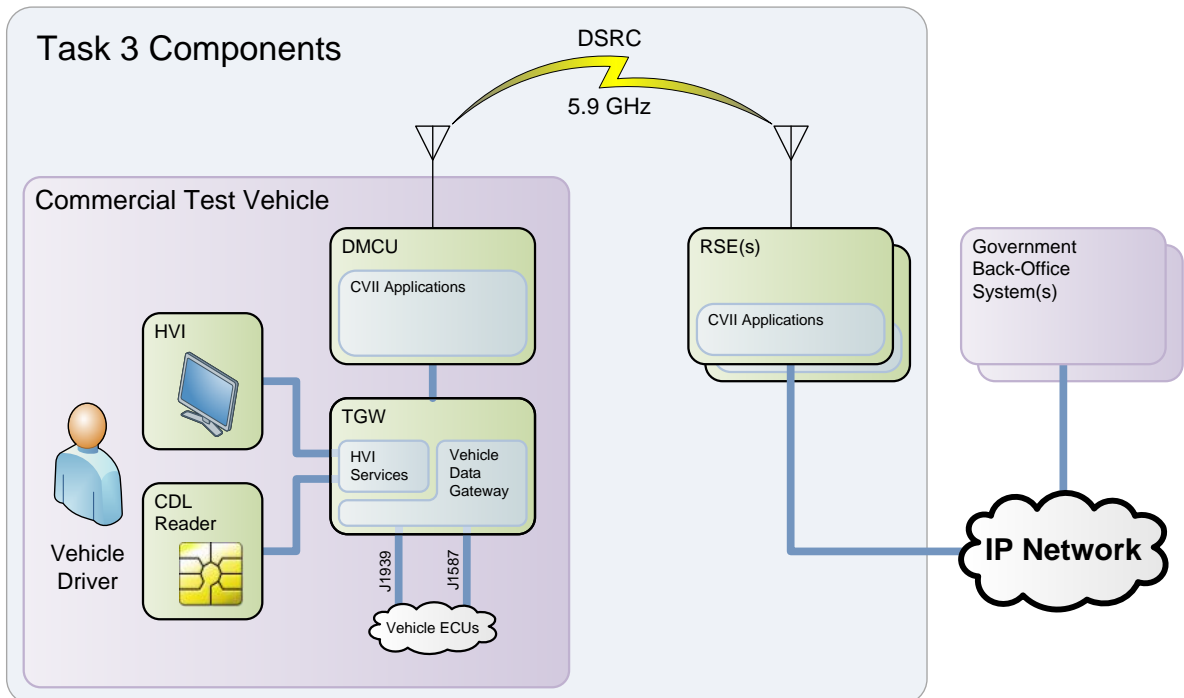
2.3 System Overview

The following components are utilized in Task 3:

- Commercial Test Vehicle includes:
 - DMCU
 - TGW
 - HVI
 - CDL Reader
- The off-board system includes:
 - RSE

[Supporting an IP Network connection to one or more NYS GBS]

The figure below shows the relationships between the Task 3 components as well as the externally connected NYS GBS.



| | | | |
|--|---|-------------------------------------|----------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 7 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | Author Phone +1 (336) 393-3171 | |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | Type of Document Concept of Operations | | |

2.4 Operational Scenarios

The operational scenarios defined in the detailed use cases in the following paragraphs represent a simple, perfect-path case and are intended to provide a platform which can be used in the future to explore the complex scenarios and processes that must be handled to produce an effective and safe service.

2.4.1 Driver Credentials Validation Service Registration

This use case supports an infrastructure configuration process which supplies the required connection parameters for the RSE to communicate with the GBS. This is a manual administrative function which is required only when the infrastructure connecting the RSE and GBS changes.

Triggers:

- An administrator needs to add or reconfigure the Driver Credentials Validation Service on an installed RSE.

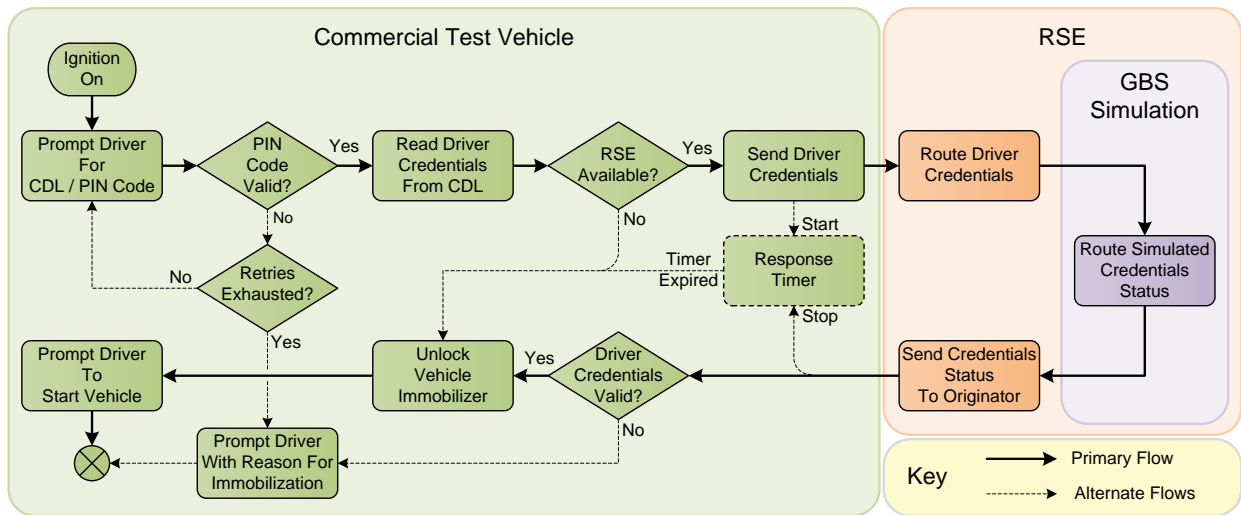
Use Case:

- An administrator logs into the affected RSE.
- The administrator configures the required routing to the GBS supporting the Driver Credentials Validation Service.
- The administrator logs out of the RSE.

| | | | |
|---|--|--|--|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 8 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

2.4.2 Vehicle Startup

This is the primary use case supporting the Driver Credentials Validation Service. The figure below shows an overview of the use case.



Triggers:

- The driver turns the vehicle's ignition switch on.

Use Case:

- The TGW prompts the driver for their CDL card.
- The driver inserts their CDL card in the CDL Reader.
- The TGW prompts the driver for their PIN code.
- The driver enters their PIN code.
- The TGW:
 - Unlocks the CDL card using the PIN code. [Alternative: PIN Code Not Valid]
 - Reads the driver credentials from the CDL card.
 - Sends the driver credentials to the DMCU and starts a fail-safe response timer. [Alternative: Fail-Safe Response Timer Expired]
- Connected to an RSE supporting the Driver Credentials Validation Service, the DMCU sends the driver credentials to the RSE and starts a response timer.

| | | | |
|--|---|-------------------------------------|----------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 9 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | Author Phone +1 (336) 393-3171 | |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | Type of Document Concept of Operations | | |

[Alternative: No RSE Available]
[Alternative: Response Timer Expired]

- The RSE:
 - Routes the driver credentials message to the GBS via the IP Network.
 - The GBS Simulation routes a simulated driver credentials status message to the RSE service via the IP Network.
 - Sends the driver credentials status message to the originating DMCU.
- The DMCU sends the driver credentials status to the TGW and stops the response timer.
- The TGW:
 - Stops the fail-safe response timer.
 - With valid or timeout driver credentials status:
[Alternative: Driver Credentials Not Valid]
 - Unlocks the vehicle immobilizer.
 - Prompts the driver to start the vehicle.
- The use case ends.

Alternative: PIN Code Not Valid:

The PIN code supplied by the driver does not unlock the CDL card.

- The TGW prompts the driver to re-enter their PIN code.
[Alternative: PIN Code Retries Exhausted]
- The Vehicle Startup Use Case resumes with the ‘Unlocks the CDL card ...’ step.

Alternative: PIN Code Retries Exhausted:

The maximum retries for the driver to enter their PIN code has been exceeded.

- The TGW prompts the driver with the reason for failure, leaving the vehicle immobilized.
- The use case ends.

Alternative: Fail-Safe Response Timer Expired:

The TGW does not get a timely response from the DMCU.

- The TGW:
 - Unlocks the vehicle immobilizer.

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 10 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
| Customer Company New York State DOT | Customer Name Rick McDonough | | Customer Phone +1 (518) 457-5871 |
| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

- Prompts the driver to start the vehicle.
- The use case ends.

Alternative: No RSE Available:

The DMCU does not currently have a connection to an RSE supporting the Driver Credentials Validation Service.

- The DMCU sends a no service status to the TGW.
- The TGW:
 - Unlocks the vehicle immobilizer.
 - Prompts the driver to start the vehicle.
- The use case ends.

Alternative: Response Timer Expired:

The DMCU does not get a timely response from the RSE.

- The DMCU sets the driver credentials status to Timeout.
- The Vehicle Startup Use Case resumes with the ‘The DMCU sends the driver credentials status ...’ step.

Alternative: Driver Credentials Not Valid:

The TGW receives an invalid driver credentials status.

- The TGW prompts the driver with the reason for failure, leaving the vehicle immobilized.
- The use case ends.

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 11 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

3 Task 3 Requirements

3.1 General Requirements

Req TASK3-002/1.0: Commercial Drivers License

The driver credentials shall be stored on a simulated CDL based on a Smart Card.

Req TASK3-003/1.0: Driver Credentials Access

A PIN code shall be required to access the stored driver credentials on the simulated CDL.

Req TASK3-004/1.0: Driver Credentials

The driver credentials used for validation shall, as a minimum, contain the following information:

- License Number
- Issuing State
- Issue Date
- Expiration Date
- Class (A, B, C)
- Name (Last, First, Middle)
- Address (Street, City, State, Zip Code)

Req TASK3-005/1.0: Driver Credentials Status

The driver credentials status shall as a minimum contain the following information:

- Status - One of the following:
 - License Valid
 - License Expired
 - License Revoked
 - Medical Certificate Expired

3.2 RSE Driver Credentials Validation Service

Req TASK3-006/1.1: Driver Credentials Validation Service Configuration

The RSE shall support an administrative interface which allows for the configuration of the driver Credentials Validation Service, including routing information to the GBS driver credentials validation application supporting the service.

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 12 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
| Customer Company New York State DOT | Customer Name Rick McDonough | | Customer Phone +1 (518) 457-5871 |
| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

Req TASK3-007/1.0: Driver Credentials Validation Service Notification

When configured appropriately, the RSE shall support Driver Credentials Validation Service notification to connected DMCU's.

Req TASK3-008/1.0: Driver Credentials Validation Message Routing

When configured appropriately, the RSE shall route a driver credentials validation message as defined in Reference [3], which was received from a DMCU, to a specified GBS over the IP Network.

Req TASK3-009/1.0: Driver Credentials Status Message Routing

When configured appropriately, the RSE shall route a driver credentials status message as defined in Reference [3], which was received from a specified GBS via the IP Network, to the DMCU that originated the driver credentials validation message for which this is a response.

Req TASK3-010/1.0: RSE Transaction Log

To the greatest degree reasonable, the RSE shall maintain a transaction log with time stamps for all messages and data connections that it handles.

3.2.1 GBS Simulation

Req TASK3-011/1.0: GBS Simulation

The RSE shall be capable of supporting a GBS simulation which meets the remaining requirements specified in Paragraph 3.2.1 to support the testing and verification of the Driver Credentials Validation Service in the absence of a GBS.

Req TASK3-012/1.0: Simulation Interface

To the greatest degree possible, the RSE simulation engine shall interface with the RSE Driver Credentials Validation service without requiring a software change.

Req TASK3-013/1.0: Driver Credentials Status Response

The RSE shall be capable of simulating the reception of a driver credentials status message from the IP Network as defined in Reference [3] for each received driver credentials validation message.

Req TASK3-014/1.0: Simulated Driver Credentials Status Message

The RSE shall utilize a simple data source, which can be easily modified, to define the simulated driver credentials status message.

Req TASK3-015/1.1: Driver Credentials Status Message Delayed Response

The RSE shall be capable of delaying the transmission of the simulated driver credentials status message with a programmable delay to support testing the system behavior resulting from GBS processing delays.

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 13 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

Req TASK3-016/1.0: Simulation Mode Message Archive

While in simulation mode, the RSE shall archive the contents of all received and simulated driver credentials messages with a time stamp reflecting the time of reception or simulation of the message.

Req TASK3-017/1.0: Driver Credentials Transaction Display

While in simulation mode, the RSE shall support the real-time display of a time-stamped list summarizing the driver credentials and returned driver credentials status in a simple, readable format sufficient to support the verification of the service as validation requests are processed.

Req TASK3-018/1.0: Driver Credentials/Status Archive Review

The RSE shall support a simple, conceptual user interface sufficient to allow a historical analysis of the simulated service operation which allows for the review of the driver credentials/status archive.

3.3 TGW Driver Credentials Validation Application

Req TASK3-019/1.0: Vehicle Immobilization

The TGW shall enable the vehicle immobilization function.

Note: The vehicle immobilization function prevents the vehicle from being started each time the ignition switch is turned on until the immobilization function is unlocked.

Req TASK3-020/1.0: Driver Identification Prompt

When the vehicle's ignition switch is turned on, the TGW shall notify the driver that the vehicle may not be started until their CDL has been verified and prompt the driver to place their CDL into the card reader.

Req TASK3-021/1.0: Driver PIN Code Prompt

When the driver inserts their CDL into the card reader, the TGW shall prompt the driver to provide their CDL PIN code and collect the PIN code.

Req TASK3-022/1.0: Driver Credentials Access

Using the driver provided CDL PIN code, the TGW shall read the driver credentials from the CDL.

Req TASK3-023/1.1: Invalid PIN Code

If the PIN code provided by the driver is invalid, the TGW shall prompt the driver for a new PIN code with a programmable maximum retry count.

Req TASK3-031/1.1: Invalid PIN Code Retries Exceeded

If the maximum retry count is exceeded, the TGW shall not disable the vehicle immobilization function and shall notify the driver of the reason for immobilization.

Req TASK3-024/1.0: Driver Credentials Transmission

The TGW shall transmit the driver credentials to the DMCU as defined in Reference [4].

| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 14 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

Req TASK3-025/1.1: Vehicle Immobilization Override

The TGW shall disable the vehicle immobilization function and shall notify the driver that the vehicle may be started:

- On receipt of a valid driver credentials status, no RSE available status, or timeout status from the DMCU as defined in Reference [4]
- On a timeout waiting for a response from the DMCU

Req TASK3-026/1.1: Invalid Driver Credentials Status

If an invalid driver credentials status is received from the DMCU as defined in Reference [4], the TGW shall not disable the vehicle immobilization function and shall notify the driver of the reason for immobilization.

3.4 DMCU Driver Credentials Validation Application

Req TASK3-027/1.0: Driver Credentials Handling

On receipt of driver credentials from the TGW as defined in Reference [4], the DMCU shall:

- In range of an RSE supporting the Driver Credentials Validation Service:
Format the driver credentials into a driver credentials validation message as defined in Reference [3]
- Not in range of an RSE supporting the Driver Credentials Validation Service:
Send a no RSE available status to the TGW as defined in Reference [4]

Req TASK3-028/1.0: Driver Credentials Validation Retries

If there is no driver credentials status response within 5 seconds, the DMCU shall retry the transmission driver credentials validation message until a response is received or 5 attempts have been exceeded.

Req TASK3-029/1.0: Driver Credentials Status

On receipt of a driver credentials status message as defined in Reference [3], the DMCU shall send the driver credentials status to the TGW as defined in Reference [4].

Req TASK3-030/1.0: Driver Credentials Status Timeout

If the driver credentials validation retries are unsuccessful, the DMCU shall send a timeout status to the TGW as defined in Reference [4].



| | | | |
|--|---|---|-------------------------------------|
| Document Number 6980-02941-01-05 | Issue Number 1.1 | Date 11-Jun-2010 | Page 15 (15) |
| Author Company Volvo Technology | Author Department, Name Mike Siebert, 6980 | | Author Phone +1 (336) 393-3171 |
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| Document Title C030588 CVII Task 3 [21-Jan-2009 to 31-Dec-2010] | | Type of Document Concept of Operations | |

Table of Requirements

| | |
|--|----|
| Req TASK3-001/1.0: Requirement Identifier | 4 |
| Req TASK3-002/1.0: Commercial Drivers License | 11 |
| Req TASK3-003/1.0: Driver Credentials Access | 11 |
| Req TASK3-004/1.0: Driver Credentials | 11 |
| Req TASK3-005/1.0: Driver Credentials Status | 11 |
| Req TASK3-006/1.1: Driver Credentials Validation Service Configuration | 11 |
| Req TASK3-007/1.0: Driver Credentials Validation Service Notification | 12 |
| Req TASK3-008/1.0: Driver Credentials Validation Message Routing | 12 |
| Req TASK3-009/1.0: Driver Credentials Status Message Routing | 12 |
| Req TASK3-010/1.0: RSE Transaction Log | 12 |
| Req TASK3-011/1.0: GBS Simulation | 12 |
| Req TASK3-012/1.0: Simulation Interface | 12 |
| Req TASK3-013/1.0: Driver Credentials Status Response | 12 |
| Req TASK3-014/1.0: Simulated Driver Credentials Status Message | 12 |
| Req TASK3-015/1.1: Driver Credentials Status Message Delayed Response | 12 |
| Req TASK3-016/1.0: Simulation Mode Message Archive | 13 |
| Req TASK3-017/1.0: Driver Credentials Transaction Display | 13 |
| Req TASK3-018/1.0: Driver Credentials/Status Archive Review | 13 |
| Req TASK3-019/1.0: Vehicle Immobilization | 13 |
| Req TASK3-020/1.0: Driver Identification Prompt | 13 |
| Req TASK3-021/1.0: Driver PIN Code Prompt | 13 |
| Req TASK3-022/1.0: Driver Credentials Access | 13 |
| Req TASK3-023/1.1: Invalid PIN Code | 13 |
| Req TASK3-031/1.1: Invalid PIN Code Retries Exceeded | 13 |
| Req TASK3-024/1.0: Driver Credentials Transmission | 13 |
| Req TASK3-025/1.1: Vehicle Immobilization Override | 14 |
| Req TASK3-026/1.1: Invalid Driver Credentials Status | 14 |
| Req TASK3-027/1.0: Driver Credentials Handling | 14 |
| Req TASK3-028/1.0: Driver Credentials Validation Retries | 14 |
| Req TASK3-029/1.0: Driver Credentials Status | 14 |
| Req TASK3-030/1.0: Driver Credentials Status Timeout | 14 |