

**Verification and Validation Plan**

**for**

***District 5 Regional Connected Vehicle Deployment Projects***

**Version: 6.0**

**April 5, 2018**



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| Created By: | Scott Agans, Metric Engineering | 1/26/2018 |
|  | Eric Wyllins, Metric Engineering | 1/26/2018 |
|  |  |  |
| Reviewed By: | Demetrius Lewis, Metric Engineering | 1/26/2018 |
|  | Ron Meyer, Atkins | 1/31/2018 |
|  | David Bremer, Atkins | 1/31/2018 |
|  | Nick Spatola, FDA | 2/6/2018 |
|  | Joe Perri, VHB | 2/13/2018 |
| Modified By: | Scott Agans, Metric Engineering | 1/26/2018 |
|  | Ron Meyer, Atkins | 1/31/2018 |
|  | David Bremer, Atkins | 1/31/2018 |
|  | Demetrius Lewis, Metric Engineering | 2/13/2018 |
|  | Scott Agans, Metric Engineering | 2/14/2018 |
|  | Demetrius Lewis, Metric Engineering | 2/19/2018 |
|  | Demetrius Lewis, Metric Engineering | 3/22/2018 |
|  | Joe Perri, VHB | 3/28/2018 |
|  | Demetrius Lewis, Metric Engineering | 4/5/2018 |
| Completed By: |  |  |

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# INTRODUCTION

## 1.1 Purpose

This document describes the evaluation methods that will be used to verify and validate that equipment being considered for use in future District Five (D5) connected vehicle (CV) deployments meets currently defined user needs. Installation, configuration, and functionality of Traffic Signal Controllers, Roadside Units (RSU), and On-Board Units (OBU) will be evaluated. Communication between a variety of Traffic Signal Controllers, RSU’s and OBU’s will also be evaluated. The document will serve as a template to record observations and findings related to evaluations performed on specific products.

## 1.2 Acronyms and Abbreviations

The following terms and definitions list is provided for reference purposes:

Acronym Definition

ATSPM Automated Traffic Signal Performance Measures

BSM Basic Safety Message

CV Connected Vehicle

CVRIA Connected Vehicle Reference Implementation Architecture

DSRC Dedicated Short Range Communication

EUE Equipment Under Evaluation

EVP Emergency Vehicle Preemption

FDOT Florida Department of Transportation

IMC Incident Management Corridor

ICMP Internet Control Message Protocol

PED Pedestrian

PoE Power over Ethernet

OBU On-Board Unit

MAP Map Data Message

RSU Roadside Unit

SPAT Signal Phase and Timing

TERL Traffic Engineering Research Laboratory

TIM Traveler Information Message

TMC Traffic Management Center

TSP Transit Signal Priority

V2I Vehicle to Infrastructure

# EVALUATION AND VALIDATION APPROACH

## 2.1 Overview

### 2.1.1 System Functions and Descriptions

Vehicle to Infrastructure (V2I) technologies capture vehicle-generated traffic data and provide information such as advisories from the infrastructure to the vehicle that inform the driver of safety, mobility, or environment-related conditions.[[1]](#footnote-2)

### 2.1.2 Evaluation Goal and Objectives

The primary goal of evaluations described in this document is to identify and demonstrate CVRIA application functionality using traffic signal controllers, RSUs, and OBUs. FDOT District Five (FDOT D5), per the project scope, has required specific CV applications be evaluated. The evaluation of the CV equipment will be conducted in two phases. Phase 1 will be bench testing conducted at the Seminole County Traffic Engineering facility, Phase 2 will be demonstration of system capabilities at the Traffic Engineering Research Lab (TERL) in Tallahassee, and Phase 3 will be field evaluation at selected intersections within Central Florida. A list and brief description of CV applications and functions to be evaluated is provided below:

* SPAT/MAP/TIM Message broadcast – The Signal Phase and Timing (SPAT) message is used to convey the current status of one or more signalized intersections. Along with the MSG\_MapData message (which describes a full geometric layout of an intersection) the receiver of this message can determine the state of the signal phasing and when the next expected phase will occur. The Traveler Information message is used to send various types of information (advisory and road sign types) to equipped devices.
* BSM receipt and forwarding – Basic Safety Messages are used in a variety of applications to exchange safety data regarding vehicle state. BSMs include vehicle-generated data such as speed, heading, and position.
* EVP – The Emergency Vehicle Preemption application provides high priority to emergency vehicles to allow safe and efficient movement through intersection.
* TSP – The Transit Signal Priority application allows transit vehicles to request signal priority at one or a series of intersections.
* Pedestrian in Signalized Crosswalk Warning – The Pedestrian in Signalized Crosswalk Warning application provides to the connected vehicle information from the infrastructure that indicates the possible presence of pedestrians in a crosswalk at a signalized intersection. The infrastructure based indication could include the outputs of pedestrian sensors or simply an indication that the pedestrian call button has been activated. This application has been defined for transit vehicles, but can be applicable to any class of vehicle. The application could also provide warning information to the pedestrian regarding crossing status or potential vehicle infringement into the crosswalk.
* Curve Speed Warning – The curve speed warning application allows connected vehicles to receive information that it is approaching a curve along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the curve and its recommended speed.
* Queue Warning – The Queue Warning (Q-WARN) application utilizes connected vehicle technologies, including vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, to enable vehicles within the queue event to automatically broadcast their queued status information (e.g., rapid deceleration, disabled status, lane location) to nearby upstream vehicles and to infrastructure-based central entities (such as the TMC). The infrastructure will broadcast queue warnings to vehicles in order to minimize or prevent rear-end or other secondary collisions.
* Vehicle Turning Right in Front of a Transit Vehicle –The Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV) application determines the movement of vehicles near to a transit vehicle stopped at a transit stop and provides an indication to the transit vehicle operator that a nearby vehicle is pulling in front of the transit vehicle to make a right turn. This application will help the transit vehicle determine if the area in front of it will not be occupied as it begins to pull away from a transit stop.
* ATSPM – Automated Traffic Signal Performance Measures functions within traffic controllers provide high-resolution data to support objectives and performance-based maintenance and operations strategies that improve safety and efficiency while cutting congestion and cost.

The primary objectives of the evaluation and validation activities described in this document are:

1. Phase I – Lab Environment
   1. Verifying that proposed CV equipment complies with national requirements, specifications, and standards.
   2. Determining if proposed CV equipment can be integrated into common traffic signal controller cabinets currently in use throughout D5.
   3. Determining if RSUs can establishing a communication link to OBUs from multiple manufacturers.
   4. Determining if RSUs can receive and transmit messages.
      1. Determining if RSUs can receive and forward BSM data from OBUs.
      2. Determining if OBUs can receive information from RSUs.
   5. Verifying the communication between RSUs and OBUs can occur on multiple channels.
   6. Determining if RSUs can communicate with the traffic controller to send/receive SPAT messages.
2. Phase II – TERL Demonstrations
   1. Demonstrating that RSUs ability to receive and transmit MAP and BSM messages in the field.
3. Phase III – Field Site Evaluation
   1. Demonstrating that RSUs ability to receive and transmit MAP and BSM messages in the field.
   2. Determine if RSUs can communicate with the traffic signal controller to send SPAT, EVP and TSP messages to multiple OBU’s.

### 

## 2.2 Evaluation and Validation Criteria

Evaluation and validation criteria were developed based on USDOT CV testing plans; independent research of CV requirements, specifications, and standards; and D5 project user needs identified to date. The user needs established the functional requirements in which the CV equipment must be capable of meeting in order to satisfy the project’s intent. Each type of CV equipment (e.g. RSU, OBU) within this evaluation plan has a different set of validation criteria based on the functional requirements.

## 2.3 Acceptance Criteria

Evaluation and validation will be deemed a success if the project team is able to confirm that equipment complies with applicable national standards, is interoperable, can communicate with local controllers, and able to provide required functionality. Success also requires that installation characteristics such as physical attributes, connections, wiring, and hardware/software requisites are understood and documented. Systems will likely incorporate a variety of connections, including Dedicated Short Range Communications (DSRC), Ethernet, cellular, and possibly other wired and wireless mediums.

# VALIDATION CASES OVERVIEW

Validation checklists are used to detail specific validation procedures and methods; relate them to required functions; and record conditions, equipment location, equipment serial numbers, and actual results for each validation. The project team will keep a log to record observations, validation conditions, and information of importance to clarify specific events associated with the evaluation and validation activities**.**

## 3.1 Validation Cases

A validation case is a set of criteria derived from the functional requirements which outlines a step-by-step verification and validation process for measuring the outcomes against the expected results. A validation case is created when similar equipment under test are bound by the same functional requirements thus having the same validation criteria. Validation cases are listed below:

**Lab Validation Cases:**

* VC 1 – EUE Requirements Compliance
  + This evaluation is intended to ensure the following:
    - The EUE is SAE compliant, meets FDOT Standard specification and user requirements.
* VC 2 – RSU to Traffic Signal Controller Integration and Communications
  + This evaluation is intended to ensure the following:
    - The RSU can be integrated into the various signal controllers
    - The RSU can translate between SAE and NTCIP Protocol
    - The RSU can receive SPAT data from a traffic signal controller
* VC 3– RSU to OBU Communications
  + This evaluation case is intended to ensure the following:
    - A communication link can be established between a variety of RSU’s and OBU’s
    - BSM’s can be transmitted between a variety of RSU’s and OBU’s
    - MAP data message can be transmitted from the RSU’s to the OBU’s
    - Communications between RSU and OBU can occur on multiple channels
* VC 4 – Traffic Signal Controller ATSPM Evaluation (This VC has no bearing on the CV evaluation for RSU and OBU)
  + This evaluation is intended to ensure the following objectives are met:
    - Ensure the Traffic Signal Controller meets the NTCIP standard specifications and is HiDef data logging capable.
    - Establish a data connection between the Traffic Signal Controller and the ATSPM server.

**Field Site Validation Cases:**

* VC 5 –OBU to RSU EVP Application
  + This evaluation is intended to ensure the following objectives are met:
    - Ensure the RSU, while connected various signal controllers, can receive EVP messages from various OBUs.
    - Ensure the RSU can communicate the EVP messages to the controller and enact the pre-emption
* VC 6 –OBU to RSU TSP Application
  + This evaluation is intended to ensure the following objectives are met:
    - Ensure the OBU can communicate with the Transit AVL/Scheduler system to relay the TSP request
    - Ensure the RSU, while connected various signal controllers, can receive TSP messages from various OBUs and enact the priority in the controller.
* VC 7 – RSU to OBU SPAT Application
  + This evaluation is intended to ensure the following objectives are met:
    - Ensure the RSU data, while connected various signal controllers, can send SPAT messages from various OBUs.

## 3.2 Validation Scenarios

Validation scenarios are derived various configuration in which the CV equipment will be wired to or communicates with various other equipment as part of this verification and validation plan. Scenarios also depict the environment in which the EUE is being evaluated within. For this evaluation there are two environments; 1) Lab environment 2) Field environment (including TERL). Validation scenarios are conducted to ensure that the end to end functioning of the equipment performs as expected in real world scenarios. Scenarios can be assigned one or multiple validation cases. Example validation scenarios are shown below:

* Scenario 1 (Lab) – Trafficware Controller to Various RSU’s to Various OBU’s
* Scenario 1 (Field) – Trafficware Controller to Various RSU’s to Various OBU’s
* Scenario 2 (Lab) – Siemens Controller to Various RSU’s to Various OBU’s
* Scenario 2 (Field) – Siemens Controller to Various RSU’s to Various OBU’s
* Scenario 3 (Lab) – Econolite Cobalt Controller to Various RSU’s to Various OBU’s
* Scenario 3 (Field) – Econolite Cobalt Controller to Various RSU’s to Various OBU’s
* Scenario 4 (Lab) – Econolite ASC3 Controller to Various RSU’s to Various OBU’s
* Scenario 4 (Field) – Econolite ASC3 Controller to Various RSU’s to Various OBU’s

## 3.3 Equipment Under Evaluation (EUE) Overview

Ethernet is the preferred method for communication connections between devices that comprise a CV system. Figure 3-1 illustrates a simple CV demonstration system for bench testing purposes. This configuration may vary by manufacturer and product design. Figure 3-2 illustrates a common RSU field installation configuration.

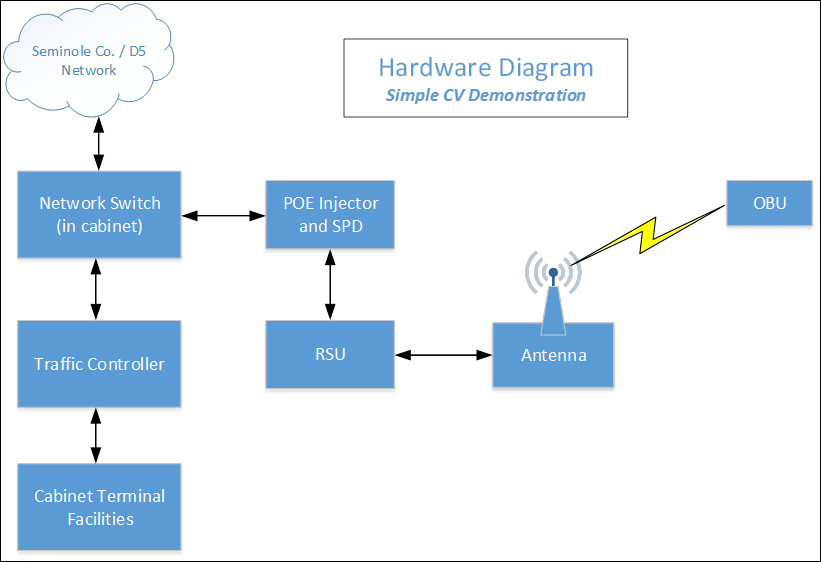


Figure 3-1: CV Demonstration System

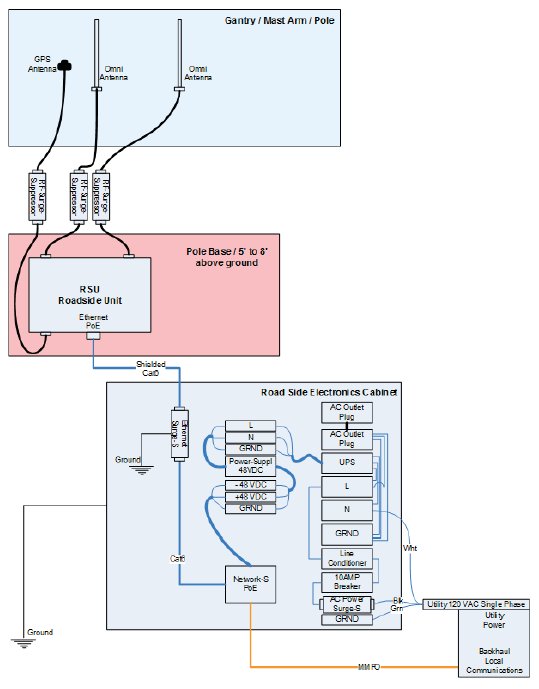


Figure 3-2: Common RSU Field Installation[[2]](#footnote-3)

## 3.4 Equipment Required

1. Laptop Computer
2. Traffic Controller Assembly
3. RSU
4. OBU
5. Multimeter
6. Ethernet Switch
7. Ethernet Cables
8. Power over Ethernet (PoE) Injectors
9. DSRC Sniffer

## 3.5 Validation Results

Validation cases and scenarios presented in Section 4.0 are used to detail specific verification procedures and method. These checklists will be used to document and to record conditions, equipment location, system configuration information, equipment serial numbers, observations, and results.

## 3.6 Validation Methods

This section describes the methods that are used to verify the equipment under evaluation satisfies the function requirements as described in each evaluation checklist.

* Documentation Verification – Requires the Vendor to provide documentation as evidence of meeting the stated requirement.
* Physical Inspection – Requires the evaluator to provide direct observation of requirements.
* Demonstration – Requires the evaluator to witness system operations in the expected or simulated environment.

# VALIDATION AND VERIFICATION ANALYSIS



## Equipment Under Evaluation Checklist

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Validation Plan** | | | | | |  |
| **Validation Case – VC1 -** EUE Requirements Compliance | | | | | |  |
| **EUE – RSU’s** | | | | | |  |
| **Validation Description** | | Ensure RSU complies with national requirements, specifications, and standards. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Review manufacturer documentation to verify that RSU complies with USDOT Specifications for DSRC Roadside Unit v.4.1 | Documentation Review | Manufacturer provides a complete test report from an accredited facility as evidence of compliance. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | No | | No | | No | | No | | No | | No | | No | | No | | No | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Review product documentation to verify that RSU manufacturer has provided FCC certifications. | Documentation Review | Manufacturer provides FCC certification documentation as evidence of compliance. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | Review manufacturer documentation to verify that RSU manufacturer has FCC license to operate for demonstrations as required for the purposes of market study. | Documentation Review | Manufacturer provides FCC license as evidence of compliance. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 4 | Review manufacturer documentation to verify that RSU incorporates use of SCMS security certificates to ensure that CV messages can be trusted. | Documentation Review | Manufacturer provides an explanation of SCMS functionality and associated documentation as evidence of compliance. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 5 | Review product documentation to determine if any open source applications on the USDOT OSADP can be installed and executed on the RSU. | Documentation Review | Manufacturer provides a list of the USDOT OSADP applications that have been successfully installed and used on the device under evaluation evidence of application support and implementation. Documentation must include details on installation, configuration, and operation; and information on when, where, and how the applications were successfully demonstrated and used on a past project. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | No | | No | | No | | No | | No | | No | | No | | No | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 6 | SAE J2735 − Dedicated Short-Range Communications (DSRC) Message Set Dictionary | Documentation Review | The manufacturer provides data regarding the message set, and its data frames and data elements have been designed, to the extent possible, to also be of potential use for applications that may be deployed in conjunction with other wireless communications technologies. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 7 | IEEE 1609.2-2016 − IEEE Standard for Wireless Access in Vehicular Environments--Security Services for Applications and Management Messages | Documentation Review | Manufacturer provides documentation to demonstrate secure message formats and processing for use by Wireless Access in Vehicular Environments (WAVE) devices, including methods to secure WAVE management messages and methods to secure application messages. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | | Working on it | |  | |  | |  | |  | |  | |  | |  | |
| 8 | IEEE 802.3at PoE+ | Documentation Review | Unit compatible with PoE+ | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **EUE – Traffic Signal Controller** | | | | | |  |
| **Test Objective Description** | | Ensure Traffic Signal Controller complies with national requirements, specifications, and standards. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment complies with NTCIP and FDOT standard specifications. | Documentation Review | Equipment complies with requirements | |  | | --- | | Naztec 980 ATC | | Siemens M60 | | Econolite ASC3 | | Econolite Cobalt | | Intelight | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |
| **EUE – OBU’s** | | | | | |  |
| **Test Objective Description – VC1** | | Ensure OBU complies with national requirements, specifications, and standards. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Review manufacturer documentation to verify that RSU complies with USDOT Specifications for DSRC Roadside Unit v.4.1 | Documentation Review | Manufacturer provides a complete test report from an accredited facility as evidence of compliance. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | |  | | --- | |  | |  | | No specs for OBUs | |  | |  | |  | |  | |  | |  | |
| 2 | Review product documentation to verify that RSU manufacturer has provided FCC certifications. | Documentation Review | Manufacturer provides FCC certification documentation as evidence of compliance. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | |  | | --- | |  | |  | |  | | No FCC license for OBUs | |  | |  | |  | |  | |  | |
| 3 | Review manufacturer documentation to verify that RSU manufacturer has FCC license to operate for demonstrations as required for the purposes of market study. | Documentation Review | Manufacturer provides FCC license as evidence of compliance. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | Choose an item. | | |  | | --- | |  | |  | |  | | No FCC license for OBUs | |  | |  | |  | |  | |  | |
| 4 | Review manufacturer documentation to verify that RSU incorporates use of SCMS security certificates to ensure that CV messages can be trusted. | Documentation Review | Manufacturer provides an explanation of SCMS functionality and associated documentation as evidence of compliance. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 5 | Review product documentation to determine if any open source applications on the USDOT OSADP can be installed and executed on the RSU. | Documentation Review | Manufacturer provides a list of the USDOT OSADP applications that have been successfully installed and used on the device under evaluation evidence of application support and implementation. Documentation must include details on installation, configuration, and operation; and information on when, where, and how the applications were successfully demonstrated and used on a past project. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | No | | No | | No | | No | | No | | No | | No | | No | | No | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 6 | SAE J2735 − Dedicated Short-Range Communications (DSRC) Message Set Dictionary | Documentation Review | The manufacturer provides data regarding the message set, and its data frames and data elements have been designed, to the extent possible, to also be of potential use for applications that may be deployed in conjunction with other wireless communications technologies. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 7 | IEEE 1609.2-2016 − IEEE Standard for Wireless Access in Vehicular Environments--Security Services for Applications and Management Messages | Documentation Review | Manufacturer provides documentation to demonstrate secure message formats and processing for use by Wireless Access in Vehicular Environments (WAVE) devices, including methods to secure WAVE management messages and methods to secure application messages. | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 8 | IEEE 802.3at PoE+ | Documentation Review | Unit compatible with PoE+ | |  | | --- | | Lear | | Cohda | | Savari | | Siemens | | Wavemobile | | Commsignia | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | No | | No | | No | | No | | No | | No | | No | | No | | No | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Scenario No. 1 Lab – Trafficware Naztec 980 ATC Controller to Various RSU to Various OBU’s Compliance** | | | | | |  |
| **Validation Case – VC2 –** RSU to Traffic Signal Controller - Integration and Communication | | | | | |  |
| **Validation Description** | | This validation case ensures the RSU can be integrated into the various signal controllers, can translate between SAE and NTCIP Protocol and can receive SPAT data from a traffic signal controller. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment can be physically installed in Trafficware cabinet without cabinet modification. | Physical Inspection | Equipment requires no significant cabinet modification. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rhythm | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | | Black box needed | | Their own equipment | | Black box needed | |
| 2 | Verify that RSU can receive SPAT data from the Traffic Signal Controller. | Demonstration | SPAT data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rhythm | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | | Example application only | | Example application only | |  | |  | |  | | From controller outputs | |  | |
| **Validation Case – VC3 –** RSU to OBU - Communication | | | | | |  |
| **Validation Description** | | This validation case ensures the RSU can establish a communication link with a variety of OBU’s, send and receive BSM’s to a variety of OBU’s, MAP data message can be transmitted from the RSU’s to the OBU’s, and Communications between RSU and OBU can occur on multiple channels. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rhythm | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE J2735 BSM to an OBU. | Demonstration | SAE J2735 BSM data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rhythm (Cohda) | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | | Siemens has no OBU | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that RSU can receive and forward a SAE J2735 BSM to various OBU on multiple channels. | Demonstration | SAE J2735 BSM data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC4 –** Traffic Signal Controller to ATSPM Server | | | | | |  |
| **Validation Description** | | This validation case ensures that the Traffic Signal Controller is HiDef data logging capable and can establish a data connection between the Traffic Signal Controller and the ATSPM server. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that Traffic Signal Controller has communication to the ATSPM server on the network. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Trafficware 980 ATC | Choose an item. |  |
| 2 | Verify that the Traffic Signal Controller is capable of producing HiDefinition. | Documentation Review | ATSPM service will be able to ping the traffic signal controller successfully | Trafficware 980 ATC | Choose an item. |  |
| 3 | Verify that the ATSPM server can pull the HiDefinition data file from the Traffic Signal Controller. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Trafficware 980 ATC | Choose an item. |  |

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| **Scenario No. 1 Field – Trafficware Naztec 980 ATC Controller to Various RSU to Various OBU’s** | | | | | |  |
| **Validation Case – VC5 – OBU to RSU EVP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages from various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Emergency Vehicle Pre-emption (EVP) shall provide a priority request from emergency vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a EVP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | | Siemens RSU emulated OBU pre-emption | |  | |  | |  | |  | |  | | Rhythm uses Cohda RSU & OBU | |  | |
| 2 | The EVP unit shall send volume, speed, occupancy, vehicle classification, incidents for signalized intersections. to EVP system. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The EVP unit shall send vehicle characteristics, position, route information. | Demonstration | Emergency vehicle wil transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC6 – RSU to OBU TSP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Transit Signal Priority (TSP) shall provide a transit signal priority request from transit vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a TSP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | | Rhythm uses Cohda RSU & OBU | |  | |
| 2 | The Transit Signal Priority System shall collect vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, number of passengers, and stopped time. | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The Transit Signal Priority System shall collect passenger count data, service type, scheduled and actual arrival time, and heading information to roadside equipment via Dedicated Short Range Communications (DSRC). | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rytm | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
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| **Validation Case – VC7 – RSU to OBU SPAT CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can forward SPAT messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE messages to an OBU (eg. BSM, MAP, TIM). | Demonstration | SAE messages BSM data can be observed via monitoring RSU. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | | No Siemens OBU | |  | |  | | Rhythm uses Cohda OBU | |  | | MioVision uses Commsignia Units | |  | |  | |
| 2 | Verify that the RSU can forward SPAT messages to OBU. | Demonstration | OBU will receive SPAT messages | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | | Example app was running | | Example app was running | |  | |  | | MioVision uses Commsignia Units | |  | |  | |

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| **Scenario No. 2 Lab – Siemens M60 Controller to Various RSU to Various OBU’s Compliance** | | | | | |  | |
| **Validation Case – VC2 –** RSU to Traffic Signal Controller - Integration and Communication | | | | | |  | |
| **Validation Description** | | This validation case ensures the RSU can be integrated into the various signal controllers, can translate between SAE and NTCIP Protocol and can receive SPAT data from a traffic signal controller. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment can be physically installed in Trafficware cabinet without cabinet modification. | Physical Inspection | Equipment requires no significant cabinet modification. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that RSU can receive SPAT data from the Traffic Signal Controller. | Demonstration | SPAT data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | No | | No | | No | | No | | Yes | | Yes | | Yes | | |  | | --- | |  | |  | | Example application | | Example application | |  | |  | |  | |  | |  | |
| **Validation Case – VC3 –** RSU to OBU – Communication – SECTION DELETED AS INDEPENDENT OF CONTROLLER | | | | | |  | |
| **Validation Case – VC4 –** Traffic Signal Controller to ATSPM Server | | | | | |  | |
| **Validation Description** | | This validation case ensures that the Traffic Signal Controller is HiDef data logging capable and can establish a data connection between the Traffic Signal Controller and the ATSPM server. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that Traffic Signal Controller has communication to the ATSPM server on the network. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Siemens M60 | Choose an item. |  |
| 2 | Verify that the Traffic Signal Controller is capable of producing HiDefinition. | Documentation Review | ATSPM service will be able to ping the traffic signal controller successfully | Siemens M60 | Choose an item. |  |
| 3 | Verify that the ATSPM server can pull the HiDefinition data file from the Traffic Signal Controller. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Siemens M60 | Choose an item. |  |

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| **Scenario No. 2 Field – Siemens M60 Controller to Various RSU to Various OBU’s** | | | | | |  |
| **Validation Case – VC5 – OBU to RSU EVP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages from various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Emergency Vehicle Pre-emption (EVP) shall provide a priority request from emergency vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a EVP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The EVP unit shall send volume, speed, occupancy, vehicle classification, incidents for signalized intersections. to EVP system. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The EVP unit shall send vehicle characteristics, position, route information. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC6 – RSU to OBU TSP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Transit Signal Priority (TSP) shall provide a transit signal priority request from transit vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a TSP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The Transit Signal Priority System shall collect vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, number of passengers, and stopped time. | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The Transit Signal Priority System shall collect passenger count data, service type, scheduled and actual arrival time, and heading information to roadside equipment via Dedicated Short Range Communications (DSRC). | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
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| **Validation Case – VC7 – RSU to OBU SPAT CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can forward SPAT messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE messages to an OBU (eg. BSM, MAP, TIM). | Demonstration | SAE messages BSM data can be observed via monitoring RSU. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that the RSU can forward SPAT messages to OBU. | Demonstration | OBU will receive SPAT messages | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |

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| **Scenario No. 3 Lab – Econolite Cobalt Controller to Various RSU to Various OBU’s Compliance** | | | | | |  | |
| **Validation Case – VC2 –** RSU to Traffic Signal Controller - Integration and Communication | | | | | |  | |
| **Validation Description** | | This validation case ensures the RSU can be integrated into the various signal controllers, can translate between SAE and NTCIP Protocol and can receive SPAT data from a traffic signal controller. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment can be physically installed in Trafficware cabinet without cabinet modification. | Physical Inspection | Equipment requires no significant cabinet modification. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that RSU can receive SPAT data from the Traffic Signal Controller. | Demonstration | SPAT data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | No | | No | | No | | No | | No | | Yes | | No | | |  | | --- | |  | |  | | Example application | | Example application | |  | |  | |  | |  | | Intermittent msgs | |
| **Validation Case – VC3 –** RSU to OBU – Communication – SECTION DELETED AS INDEPENDENT OF CONTROLLER | | | | | |  | |
| **Validation Case – VC4 –** Traffic Signal Controller to ATSPM Server | | | | | |  | |
| **Validation Description** | | This validation case ensures that the Traffic Signal Controller is HiDef data logging capable and can establish a data connection between the Traffic Signal Controller and the ATSPM server. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that Traffic Signal Controller has communication to the ATSPM server on the network. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite Cobalt | Choose an item. |  |
| 2 | Verify that the Traffic Signal Controller is capable of producing HiDefinition. | Documentation Review | ATSPM service will be able to ping the traffic signal controller successfully | Econolite Cobalt | Choose an item. |  |
| 3 | Verify that the ATSPM server can pull the HiDefinition data file from the Traffic Signal Controller. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite Cobalt | Choose an item. |  |

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| **Scenario No. 3 Field – Econolite Cobalt Controller to Various RSU to Various OBU’s** | | | | | |  |
| **Validation Case – VC5 – OBU to RSU EVP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages from various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Emergency Vehicle Pre-emption (EVP) shall provide a priority request from emergency vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a EVP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The EVP unit shall send volume, speed, occupancy, vehicle classification, incidents for signalized intersections. to EVP system. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The EVP unit shall send vehicle characteristics, position, route information. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC6 – RSU to OBU TSP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Transit Signal Priority (TSP) shall provide a transit signal priority request from transit vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a TSP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The Transit Signal Priority System shall collect vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, number of passengers, and stopped time. | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The Transit Signal Priority System shall collect passenger count data, service type, scheduled and actual arrival time, and heading information to roadside equipment via Dedicated Short Range Communications (DSRC). | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
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| **Validation Case – VC7 – RSU to OBU SPAT CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can forward SPAT messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE messages to an OBU (eg. BSM, MAP, TIM). | Demonstration | SAE messages BSM data can be observed via monitoring RSU. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that the RSU can forward SPAT messages to OBU. | Demonstration | OBU will receive SPAT messages | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |

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| **Scenario No. 3 Lab – Econolite ASC3 Controller to Various RSU to Various OBU’s Compliance** | | | | | |  | |
| **Validation Case – VC2 –** RSU to Traffic Signal Controller - Integration and Communication | | | | | |  | |
| **Validation Description** | | This validation case ensures the RSU can be integrated into the various signal controllers, can translate between SAE and NTCIP Protocol and can receive SPAT data from a traffic signal controller. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment can be physically installed in Trafficware cabinet without cabinet modification. | Physical Inspection | Equipment requires no significant cabinet modification. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that RSU can receive SPAT data from the Traffic Signal Controller. | Demonstration | SPAT data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | No | | No | | No | | Yes | | No | | Yes | | Yes | | No | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC3 –** RSU to OBU – Communication – SECTION DELETED AS INDEPENDENT OF CONTROLLER | | | | | |  | |
| **Validation Case – VC4 –** Traffic Signal Controller to ATSPM Server | | | | | |  | |
| **Validation Description** | | This validation case ensures that the Traffic Signal Controller is HiDef data logging capable and can establish a data connection between the Traffic Signal Controller and the ATSPM server. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that Traffic Signal Controller has communication to the ATSPM server on the network. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |
| 2 | Verify that the Traffic Signal Controller is capable of producing HiDefinition. | Documentation Review | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |
| 3 | Verify that the ATSPM server can pull the HiDefinition data file from the Traffic Signal Controller. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |

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| **Scenario No. 4 Field – Econolite ASC3 Controller to Various RSU to Various OBU’s** | | | | | |  |
| **Validation Case – VC5 – OBU to RSU EVP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages from various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Emergency Vehicle Pre-emption (EVP) shall provide a priority request from emergency vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a EVP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The EVP unit shall send volume, speed, occupancy, vehicle classification, incidents for signalized intersections. to EVP system. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The EVP unit shall send vehicle characteristics, position, route information. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC6 – RSU to OBU TSP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Transit Signal Priority (TSP) shall provide a transit signal priority request from transit vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a TSP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The Transit Signal Priority System shall collect vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, number of passengers, and stopped time. | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The Transit Signal Priority System shall collect passenger count data, service type, scheduled and actual arrival time, and heading information to roadside equipment via Dedicated Short Range Communications (DSRC). | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
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| **Validation Case – VC7 – RSU to OBU SPAT CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can forward SPAT messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE messages to an OBU (eg. BSM, MAP, TIM). | Demonstration | SAE messages BSM data can be observed via monitoring RSU. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that the RSU can forward SPAT messages to OBU. | Demonstration | OBU will receive SPAT messages | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |

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| **Scenario No. 5 Lab – Intelight Controller to Various RSU to Various OBU’s Compliance** | | | | | |  | |
| **Validation Case – VC2 –** RSU to Traffic Signal Controller - Integration and Communication | | | | | |  | |
| **Validation Description** | | This validation case ensures the RSU can be integrated into the various signal controllers, can translate between SAE and NTCIP Protocol and can receive SPAT data from a traffic signal controller. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that equipment can be physically installed in Trafficware cabinet without cabinet modification. | Physical Inspection | Equipment requires no significant cabinet modification. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | No | | Yes | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that RSU can receive SPAT data from the Traffic Signal Controller. | Demonstration | SPAT data can be observed via monitoring RSU console and Ethernet data output. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  | | --- | | No | | Yes | | No | | No | | Yes | | No | | Yes | | Yes | | No | | |  | | --- | | Vendor needs more time | |  | | Example application | | Example application | |  | |  | |  | |  | | Therefore no filed test | |
| **Validation Case – VC3 –** RSU to OBU – Communication – SECTION DELETED AS INDEPENDENT OF CONTROLLER | | | | | |  | |
| **Validation Case – VC4 –** Traffic Signal Controller to ATSPM Server | | | | | |  | |
| **Validation Description** | | This validation case ensures that the Traffic Signal Controller is HiDef data logging capable and can establish a data connection between the Traffic Signal Controller and the ATSPM server. | | | |  | |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply?** | **Notes** |
| 1 | Verify that Traffic Signal Controller has communication to the ATSPM server on the network. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |
| 2 | Verify that the Traffic Signal Controller is capable of producing HiDefinition. | Documentation Review | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |
| 3 | Verify that the ATSPM server can pull the HiDefinition data file from the Traffic Signal Controller. | Functional Inspection | ATSPM service will be able to ping the traffic signal controller successfully | Econolite ASC3 | Choose an item. |  |

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| **Scenario No. 6 Field – Intelight Controller to Various RSU to Various OBU’s** | | | | | |  |
| **Validation Case – VC5 – OBU to RSU EVP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages from various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Emergency Vehicle Pre-emption (EVP) shall provide a priority request from emergency vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a EVP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | | Siemens RSU emulated OBU pre-emption | |  | |  | |  | |  | |  | |  | | Not successful in lab | |
| 2 | The EVP unit shall send volume, speed, occupancy, vehicle classification, incidents for signalized intersections. to EVP system. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The EVP unit shall send vehicle characteristics, position, route information. | Demonstration | Emergency vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Validation Case – VC6 – RSU to OBU TSP CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can receive EVP messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Transit Signal Priority (TSP) shall provide a transit signal priority request from transit vehicle OBU to signal controller via the RSU. | Demonstration | Signal Controller will receive a TSP request | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | The Transit Signal Priority System shall collect vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, number of passengers, and stopped time. | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 3 | The Transit Signal Priority System shall collect passenger count data, service type, scheduled and actual arrival time, and heading information to roadside equipment via Dedicated Short Range Communications (DSRC). | Demonstration | Transit vehicle will transmit data via OBU | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
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| **Validation Case – VC7 – RSU to OBU SPAT CV Application** | | | | | |  |
| **Validation Description** | | This validation case ensures that the RSU can forward SPAT messages to various OBU’s. | | | |  |
| **Step** | **Description** | **Verification Method** | **Expected Result(s)** | **EUE** | **Comply with OBU?**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lear | Siemens | Savari | Wavemobile | Cohda | Commsignia | MioVision | Rythmn | TrafficCast | | **Notes** |
| 1 | Verify that RSU can receive and forward a SAE messages to an OBU (eg. BSM, MAP, TIM). | Demonstration | SAE messages BSM data can be observed via monitoring RSU. | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 2 | Verify that the RSU can forward SPAT messages to OBU. | Demonstration | OBU will receive SPAT messages | |  | | --- | | Savari | | Siemens | | Cohda | | Lear | | Commsignia | | Wavemobile | | MioVision | | Rythmn | | TrafficCast | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | |  | | --- | |  | |  | |  | |  | |  | |  | |  | |  | |  | |

1. V2I Resources. (2018). Retrieved from https://www.its.dot.gov/v2i/ [↑](#footnote-ref-2)
2. Curtis, D. (2016). DSRC RSU Specifications Document v4.1. Retrieved from http://www.fdot.gov/traffic/Doc\_Library/PDF/USDOT%20RSU%20Specification%204%201\_Final\_R1.pdf. [↑](#footnote-ref-3)