


Engineering Release Notice (ERN)	Location	Change Description: A=Added, W=Was, U=Deleted	Document Release Status <b>Version 3.5</b>	
			Release Date <b>20111202</b>	Modification Count <b>16</b>

# SYSTEM REQUIREMENT DESCRIPTION

## 5.9GHz DSRC Vehicle Awareness Device Specification


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 <b>Research and Innovative Technology Administration</b>	Document Title: <b>Vehicle Awareness Device Specification</b>			
	Document Type: <b>System Requirement Description</b>			
	Document No. <b>USDOTVAD</b>	Issue Index <b>003.5</b>	Volume No <b>01</b>	Page No <b>1</b>

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# 1 INTRODUCTION

## 1.1 What is the purpose of this document?

This document will set the requirements for an automotive grade electronic module capable of sending a the SAE J2735-200911 defined “Basic Safety Message” over a Dedicated Short Range Communication (DSRC) wireless communications link.

## 1.2 Who should read this document?

Suppliers interested in building devices based on the requirements provided in this document.

## 1.3 How is this document organized?

The Structure of this document is as follows:

**Section 1** – Introduction: Document’s scope, revision history and requisite specifications.

**Section 2** – Terminology: describes the definitions, concepts, and abbreviations used throughout the document.

**Section 3** – System Description: Describes the system layout and the allocation of responsibilities and communication for the system components.

**Section 4** – System Requirements: Describes the System level requirements.

**Section 5** – Functional Requirements: Describes the subsystem and/or component level requirements.


**Section 6** – Test Requirements: Describes the system testing requirements.

## 1.4 How do you receive more information?


Additional information is available in the documents listed in section 1.6. Questions are answered by the person responsible for this document (see section 1.5).

## 1.5 Revision History

Rev.	Vers.	Date	Description	Approved by	Responsible
001	001	07/01/10	First Issue	Walton Fehr	Frank Perry
002	001.1	07/01/10	Word “suppler” changed to “supplier” in numerous places	Walton Fehr	Walton Fehr
003	001.3	11/12/10	Changed the “HIM” acronym to “HIA” to better represent the phrase “Here I Am”  Updated the “Requisite Documents” Section based on updates to cited documents\standards	Walton Fehr	Maureen Marshall

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			Updated numerous Requirements based on Supplier feedback and questions  Added Requirements 98-101 based on Supplier feedback and questions (Note: These requirements were added to the appropriate Sections of the Document, NOT at the end of the Document)  Deprecated Requirements 55, 78, and 79 as these Requirements are no longer relevant		
004	001.4	12/27/10	Comments inserted by WLF	Walton Fehr	Walton Fehr
005	001.5	12/28/10	Updated SRD template and responded to WLF comments	Walton Fehr	Maureen Marshall
006	001.6	12/29/10	Status change from Preliminary to Initial Sample Delivery,	Walton Fehr	Walton Fehr
007	002.0	4/22/11	Restructured and revised to include initial comments from device builders and to reflect corollary work on the ASD Requirements Specification.	Walton Fehr	Jim Marousek
008	002.1	5/3/2011	Incorporated feedback from vendor feedback sessions. Added requirements for system timing (both source and standard). Added clarification to device power requirements. Revised configuration file format to CSV text file.	Walton Fehr	Jim Marousek
009	002.2	5/5/2011	Included a list of mandatory requirements that will be considered optional for a lot of material being acquired for Test Bed use ONLY. These requirements will be mandatory in future devices.	Walton Fehr	Walton Fehr
010	002.3	7/7/2011	Revised to reference the latest version (Draft 9) the IEEE 1609.2 Standard.	Walton Fehr	Jim Marousek
011	003.0	10/3/2011	1. Replaced references to “Here I Am” with the term “vehicle awareness”. 2. Replaced USDOTHIA with the term “USDOTOBE”. 3. Renumbered (sequenced) requirements 4. Removed the list of mandatory requirements. 5. Added Section 5.4 covering Secure “Non-DSRC” IP communications. 6. Added Appendix C – Security Profile 7. Added Appendix D – Firewall Rules	Walton Fehr	Jim Marousek
012	003.1	10/4/2011	1. Final comment resolution	Walton Fehr	Walton Fehr

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			2. Reference to FACRA connectors added		
013	003.2	10/15/2011	1. Updated Minimum Performance Reference 2. Resolved comments from the Certification team 3. Operating state names changed, clarified	Walton Fehr	Walton Fehr
014	003.3	11/1/2011	1. Included new connector diagrams 2. Addressed comments from vendor review meeting 3. Added yaw rate requirements 4. Changed "System Message Log" to "Transmitted Message Log"	Walton Fehr	Jim Marousek
015	003.4	11/25/2011	1. Updated 1609.2 draft version reference 2. SRD-USDOTOBE-003-SYS015v001 Conducted Power Lead Transients requirement added 3. SRD-USDOTOBE-003-SYS016v001 Reversed Battery Leads requirement added 4. SRD-USDOTOBE-003-ReqINT003v001 Local Systems Interface (LSI) updated to indicate that a removable memory device is mandatory 5. SRD-USDOTOBE-003-ReqBSM034v001 EventFlag DF Persistence changed from Optional to Mandatory 6. SRD-USDOTOBE-003-ReqBSM035v001 EventFlag DF HardBraking Event Flag changed from Optional to Mandatory 7. Reference to PSID list in RSE requirements speciation added 8. SRD-USDOTVAD-003-ReqDRS002v001 changed from 20,000 to 200,000 certificate for storage purposes	Walton Fehr	Walton Fehr
016	003.5	12/02/2011	1. Added missing "Req" clause to SYS requirements. 2. Included 3 additional BSM Part II requirements in Section 5.5.2. Two of which are refinements to the Path Prediction DF and the third involves the DE_VehicleType field. 3. Added HDOP to Acronym List	Walton Fehr	Patrick Chuang Jim Marousek

## 1.6 Requisite Documents


This section contains reference documents, and their appropriate versions, required to meet the requirements described in this document. The Standard Documents listed in the “Reference” portion of the requirements relate to the Standards Documents listed here:

- CAMP VSC3 – Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements, Revision 9.0, 10/10/2011 (available upon request)
- CAMP VSC3 – Interoperability Issues of Vehicle-to-Vehicle Based Safety System Project (V2V-Interoperability) – Task 5: Security Management - Subtask 2: Security System Design Specification, September 14, 2011.
- CAMP VSC3 – Congestion Control Document (to be made available upon request)
- IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9\_3-2011-09
- IEEE 1609.3-2010, August 2010
- IEEE 1609.4-2010, August 2010
- IEEE P1609.12, Draft 20
- IEEE 802.11-2007
- IEEE 802.11p- 2010
- Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, & 95 Amendments for Dedicated Short Range Communications Services and Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Service in the 5.850-5.925 GHz Band (5.9 GHz Band).
- SAE J551: Vehicle Electromagnetic Immunity – Electrostatic Discharge
- SAE J1113-11 2007-06: Immunity to Conducted Transients on Power Leads
- SAE J1211: Handbook for Robustness Validation of Automotive Electrical/Electronic Modules
- SAE J2735 2009-11: Dedicated Short Range Communication (DSRC) Message Set Dictionary
- Vehicle Power Connector Description (see Appendix A)
- USCAR18-2 FAKRA SMB RF Connector Supplement
- USDOT “5.9GHz DSRC Roadside Equipment” Device Specification, version 2.2

## 2 TERMINOLOGY

### 2.1 Definitions

Definition	Description
Alternating mode	The radio switches between the Control Channel and the Service Channel
Authorized Entity	An approved entity (person or software application) with security credentials that authorize attempted operations or activities.
Automotive Grade	End-application solutions, devices, and development tools supporting the automotive industry
Certificate	An electronic document which uses a digital signature, typically from a Certificate Authority to bind a public key with an identity of the person or organization holding the certificate.
Continuous mode	The radio does not switch channels. It only uses 1 channel

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Digital Signature	A digital signature (created using a mathematical algorithm) gives a recipient of an electronic message assurance that the message was created by the sender, and that it is unaltered.
Latency	The latency of a J2735 BSM data element/frame is defined as the maximum age of the data in the outgoing BSM
Meaningful Value	A Valid Value for a data element within a Basic Safety Message which is not Unavailable” value.
Non-DSRC	Communications protocol outside of the 5.9GHz DSRC band
Public Key	Part of a mathematically related public/private key pair, and used to digitally sign and / or encrypt electronic messages or documents.
Sign	Digitally signing a electronic message or document using a signature.
Valid Value	A value for a data element within a Basic Safety Message that has the correct data type and is within the limits of the value as defined in SAE J2735. A value of “Unavailable” is defined as valid.
WAVE Short Message Protocol	Networking protocol specifically designed for V2X communications.
Wi-Fi	Generic term for communications technologies including wireless local area network (WLAN) which are based on the IEEE 802.11 standards.

## 2.2 Concepts


### 2.2.1 Identification of Requirements

This is the nomenclature used for requirements identification.

[Document type]-[system]-[issue number]-**Req**[requirement section][requirement number]v[requirement version number]

The following table explains how the requirements nomenclature is constructed and numbered:

Field	Content Description												
document type	This is a constant text string set to “SRD”, which is an acronym for “System Requirements Description”												
System	<p>This is a constant text string set to the system(s) to which the requirement applies.</p> <table> <tr> <td>USDOTASD</td><td>Unique to the Aftermarket Safety Device</td></tr> <tr> <td>USDOTISD</td><td>Unique to the Integrated System Device</td></tr> <tr> <td>USDOTOB</td><td>Common to the ASD, ISD, RSD and Vehicle Awareness Device</td></tr> <tr> <td>USDOTRSE</td><td>Roadside Equipment Device</td></tr> <tr> <td>USDOTRSD</td><td>Unique to the Retrofit Safety Device</td></tr> <tr> <td>USDOTVAD</td><td>Unique to the Vehicle Awareness Device</td></tr> </table>	USDOTASD	Unique to the Aftermarket Safety Device	USDOTISD	Unique to the Integrated System Device	USDOTOB	Common to the ASD, ISD, RSD and Vehicle Awareness Device	USDOTRSE	Roadside Equipment Device	USDOTRSD	Unique to the Retrofit Safety Device	USDOTVAD	Unique to the Vehicle Awareness Device
USDOTASD	Unique to the Aftermarket Safety Device												
USDOTISD	Unique to the Integrated System Device												
USDOTOB	Common to the ASD, ISD, RSD and Vehicle Awareness Device												
USDOTRSE	Roadside Equipment Device												
USDOTRSD	Unique to the Retrofit Safety Device												
USDOTVAD	Unique to the Vehicle Awareness Device												

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Field	Content Description																						
issue number	This is set to the current issue number of this Systems Requirements Description.																						
requirement section	<p>This is set to the functional category of the requirement and will be one of the following:</p> <table border="1"> <tr><td>BSM</td><td>Basic Safety Messaging</td></tr> <tr><td>COM</td><td>Other “Non-DSRC” Communications</td></tr> <tr><td>DRS</td><td>DSRC Radio Subsystem</td></tr> <tr><td>INT</td><td>Interface Requirements</td></tr> <tr><td>MPS</td><td>Message Processing System</td></tr> <tr><td>OMC</td><td>Operations, Management &amp; Control</td></tr> <tr><td>POS</td><td>Positioning</td></tr> <tr><td>SEC</td><td>Security</td></tr> <tr><td>SYS</td><td>System</td></tr> <tr><td>TML</td><td>Transmitted Message Log</td></tr> <tr><td>TST</td><td>Testing</td></tr> </table>	BSM	Basic Safety Messaging	COM	Other “Non-DSRC” Communications	DRS	DSRC Radio Subsystem	INT	Interface Requirements	MPS	Message Processing System	OMC	Operations, Management & Control	POS	Positioning	SEC	Security	SYS	System	TML	Transmitted Message Log	TST	Testing
BSM	Basic Safety Messaging																						
COM	Other “Non-DSRC” Communications																						
DRS	DSRC Radio Subsystem																						
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MPS	Message Processing System																						
OMC	Operations, Management & Control																						
POS	Positioning																						
SEC	Security																						
SYS	System																						
TML	Transmitted Message Log																						
TST	Testing																						
requirement number	This is a numeric identifier for each requirement ranging from 001 up to 999 and each filed value will be unique within a defined <i>requirement section</i> (see above).																						
requirement version number	This is set to the current version number of the individual requirement.																						

The following example illustrated how the requirements within this SRD are numbered:

#### **SRD-USDOBE-003-Req 004v001**

This requirement was introduced in the first issue of the SRD for the collective systems defined as USDOBE. It is the forth requirement in the document and it is the first version of the requirement.


#### **SRD-USDOTVAD-003-Req 001v001**

This requirement was updated in the third issue of the SRD for system USDOTVAD. It is the first requirement in the document and it has been updated to a second version.


#### **SRD-USDOTVAD-003-Req 009v001**

This requirement was introduced in the third version of the SRD for system USDOTVAD. It is the ninth requirement in the document and it is the first version of the requirement.

## **2.3 Abbreviations**

Abbr.	Description	Definition			
AC	Access Category	See IEEE 802.11-2007			
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Abbr.	Description	Definition
ACL	Access Control List	
AIFS	Arbitration Interframe Space	See IEEE 802.11-2007
ASN.1	Abstract Syntax Notation One	Standard and flexible notation that describes structures for representing, encoding and decoding data.
ASD	Aftermarket Safety Device	
BSM	Basic Safety Message	
C	Celsius	Unit of temperature
CA	Certificate Authority	
CAMP	Crash Avoidance Metrics Partnership	
CCH	Control Channel	
CFR	Code of Federal Regulations	
CONUS	Continental United States	
COTS	Commercial Off the Shelf	
CRL	Certificate Revocation List	
CWmin	Contention Window Minimum	See IEEE 802.11-2007
dB	Decibel	
DC	Direct Current	
DSRC	Dedicated Short Range Communications	
EDCA	Enhanced Distributed Channel Access	
EEBL	Electronic Emergency Brake Light	
EMI	Electromagnetic Interference	
ESD	Electrostatic Discharge	
FCC	Federal Communications Commission	
GB	Gigabytes	Units of storage consisting of approximately $10^9$ 8-bit characters
GHz	Gigahertz	
GPS	Global Positioning System	
HDOP	Horizontal Dilution of Precision	
HMI	Human Machine Interface	
IEEE	Institute of Electrical and Electronic Engineers	
IP	Internet Protocol	
ISD	Integrated System Device	
km	Kilometer	
LSI	Local Systems Interface	
mA	Milliamp	Unit of electrical current
MAC	Media Access Control	
MB	Megabyte	Units of storage, consisting of approximately $10^6$ 8-bit characters
Mbps	Megabytes per second	
MHz	Megahertz	
MIB	Management Information Base	
MPDUs	MAC Protocol Units	


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Abbr.	Description	Definition
ms	Millisecond	
MTBF	Mean Time Between Failure	
OBE	On Board Equipment	
OFDM	Orthogonal Frequency-Division Multiplexing	
OSI	Open Systems Interconnection	
OTA	Over-the-Air	
PHY	Physical layer	Refers to a specific layer in the Open Systems Interconnection (OSI) reference model
PSID	Provider Service Identifier	
QOS	Quality of Service	
RF	Radio Frequency	
RSD	Retrofit Safety Device	
RSE	Roadside Equipment	
RSU	Roadside Unit	
SAE	Society of Automotive Engineers	
SCH	Service Channel	
SD	Secure Digital	
SRD	System Requirements Description	Describes requirements for a given system
SVC	Service Channel	
TXOP	Transmission Opportunity	See IEEE 802.11-2007
USB	Universal Serial Bus	
UTC	Universal Time, Coordinated	
VAD	Vehicle Awareness Device	
V2I	Vehicle-to-Infrastructure	
V2V	Vehicle-to-Vehicle	
V2X	Vehicle-to-(Infrastructure and/or Vehicle)	
VSC3	Vehicle Safety Communications 3 (Consortium)	
WAAS	Wide Area Augmentation System	
WAVE	Wireless Access in Vehicular Environments	
WiMAX	Worldwide Interoperability for Microwave Access	
WSM	WAVE Short Message	
WSMP	WAVE Short Message Protocol	
WSMP-S	WSMP safety supplement	

## 3 SYSTEM DESCRIPTION

### 3.1 Functional Description

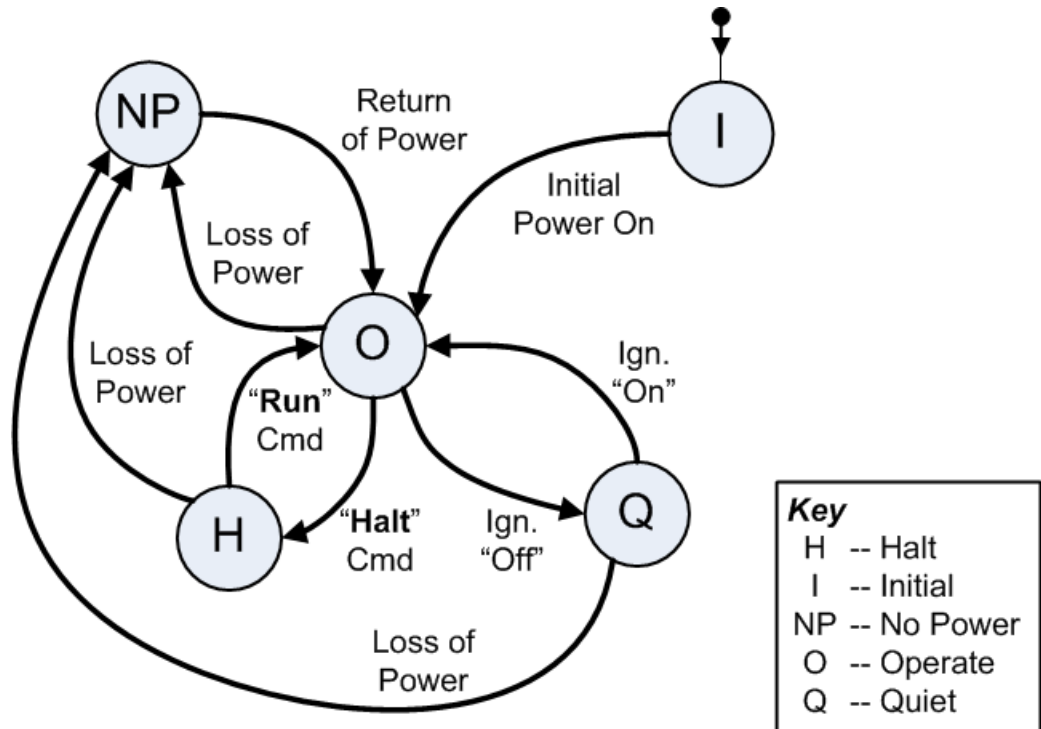
The device discussed in this document is an automotive grade electronic module capable of sending a “Vehicle Awareness” message based on the Basic Safety Message defined in SAE J2735-200911. The message is to be transmitted over a DSRC Link as defined in the IEEE 1609 suite and IEEE 802.11p 2010 standards.

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## 3.2 System Design

The automotive grade electronic module is intended for installation in various vehicles types ranging from light duty vehicles, whose weight is less than 10,000 pounds; to heavy duty class 8 trucks. This device will be installed in a vehicle without requiring connection to proprietary in-vehicle systems. It must be capable of sending and receiving the Basic Safety Message as defined in SAE J2735-200911, over a DSRC 5.9 GHz wireless communications link, as defined in the IEEE 1609 suite and IEEE 802.11p 2010 standards. The device should be capable of data storage, message processing, transmitting and receiving, as defined throughout this specification.

The Vehicle Awareness Device will have a set of operational states as illustrated in the following diagram.

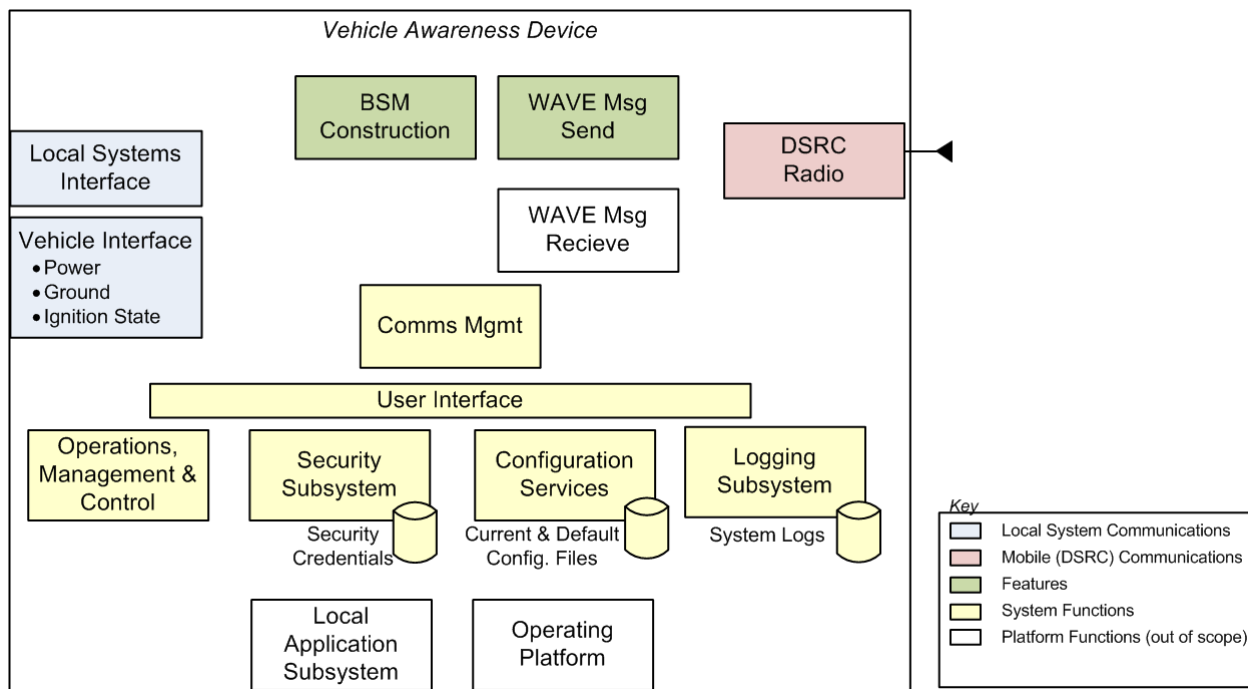


**Figure 1.0 – Vehicle Awareness Device State Diagram**

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### 3.3 System Layout

The diagram below is for reference only. Only shaded blocks are discussed in this document.



**Figure 1.0 Vehicle Awareness Device Diagram**

## 4 SYSTEM REQUIREMENTS

### 4.1 Mechanical Requirements

The vehicle awareness device shall meet all of the indicated requirements listed within this section.

#### 4.1.1 Device Installation

##### SRD-USDOTOBE-003-ReqSYS001v001 Device Installation

**Description:** The installation and removal of the onboard equipment device shall not damage the vehicle external body panels or interior trim, instrument panel, or any other Original Equipment Manufacturer provide or installed portion of the vehicle.

*Reference:* None

*Purpose:* Enables vehicle to be used during test activities without permanent modification or change; other than the expected “wear and tear” resulting from normal vehicle operations.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

##### SRD-USDOTOBE-003-ReqSYS002v001 Device Mounting

**Description:** The onboard equipment device shall be mountable as an “aftermarket” device complying with state and local regulations and/or guidance related to “aftermarket” device mountings.

*Reference:* None

*Purpose:* Enables vehicle independent mounting in the vehicle


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Analysis

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## 4.1.2 Device Size

### SRD-USDOBE-003-ReqSYS003v001 Windshield Mounted Device Form Factor

**Description:** The mounted onboard equipment device shall be limited in form factor such that, if mounted on either the windshield or the dashboard, the onboard equipment device does not obstruct the driver's field of view more than a windshield mounted transponder toll tag or a dashboard mounted commercial-off-the-shelf (COTS) navigation device.

*Reference:* None

*Purpose:* Ensures unobstructed driver's field of view.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Inspection

### SRD-USDOTVAD-003-ReqSYS001v001 Vehicle Interior Mounted Device Form Factor

**Description:** The mounted vehicle awareness device shall be limited in form factor such that, if it is to be mounted in the vehicle interior, it shall have maximum physical dimensions of 200mm by 120mm by 30mm.

*Reference:* None

*Purpose:* Allows for more installation locations with simpler attachment mechanisms.

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Inspection

## 4.2 Performance Requirements

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## SRD-USDOTOBE-003-ReqSYS004v001 Device Transmitter Failure

**Description:** If the onboard equipment device stops transmitting, for any reason, it shall signal ‘device needs servicing’, the manner of signaling being specified in the onboard equipment device’s operating manual.

*Reference:* None

*Purpose:* Inform the vehicle operator or maintenance technician that the device is malfunctioning

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## SRD-USDOTOBE-003-ReqSYS005v001 Mean Time Between Failure (MTBF)

**Description:** The onboard equipment device shall have a MTBF of 10,000 hours or greater.

*Reference:* None

*Purpose:* Maximizes vehicle\device availability time during the Test.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

## SRD-USDOTVAD-003-ReqSYS002v001 Vehicle Types

**Description:** The vehicle awareness device shall meet requirements when installed in the following Vehicle Types:

- Light Duty Passenger Vehicles (i.e. 2010 Toyota Corolla LE 4-door sedan)
- Light Duty (1/2 Ton) Trucks (i.e. 2010 Ford F-150 XL with regular cab and Styleside 8ft box)
- Class 8 Tractor with Trailer (i.e. 2010Kenworth T660 tractor with extended day cab and a 53’ Dorsey dry van.)

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Note: Test conductor will make final vehicle choices with concurrence of the vehicle awareness device makers

*Reference:* None

*Purpose:* Provides for a large, diverse, field of Test Vehicles

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

## 4.3 Environmental Requirements

The all components of the device such as the main unit and antennae, and all equipment such as cabling shall be designed to operate without failure under all weather conditions experienced in the United States and its territories. The device must also meet all the defined requirements in this section.

### 4.3.1 Operating Voltage

#### SRD-USDOBE-003-ReqSYS006v001 Device Power Source

**Description:** An onboard equipment device, powered from a vehicle power source, shall operate at a range of +9 volts to +16 volts direct current (DC) nominal.

*Reference:* None

*Purpose:* Enables the device to be powered from a vehicle power source

*Disposition:* Mandatory, if the device is powered from a vehicle power source; otherwise, Optional

*Performance*


*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### 4.3.2 Operating Current

#### SRD-USDOBE-003-ReqSYS007v001 Maximum Operating Current

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**Description:** When the onboard equipment device is powered from a vehicle power source, the vehicle awareness device shall not exceed a maximum of 1 amp in the Halt, Operate, and Initial modes.

Note: The vehicle power source can be either a steady “hot at all time” battery feed, a switched battery feed, or a combination of the two. It is up to the device vendor to determine how their device will be powered.

*Reference:* None

*Purpose:* Prevents device from overloading existing vehicle electrical systems.

*Disposition:* Mandatory, if the device is powered from a vehicle power source; otherwise, Optional

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqSYS008v001 Maximum Standby Current**

**Description:** When the onboard equipment device is powered from a vehicle power source, the vehicle awareness device shall not exceed in Quiet (Ignition off) mode at a maximum of 1.0mA.

Note: The vehicle power source can be either a steady “hot at all time” battery feed, a switched battery feed, or a combination of the two. It is up to the device vendor to determine how their device will be powered.

*Reference:* None

*Purpose:* Prevents device from draining vehicle battery during prolonged vehicle standby durations

*Disposition:* Mandatory, if the device is powered from a vehicle power source; otherwise, Optional


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### **4.3.3 Temperature**

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#### SRD-USDOTOBE-003-ReqSYS009v001 Temperature Operating Range

**Description:** The onboard equipment device shall operate at a temperature range of -40°C to +85°C.

*Reference:* None

*Purpose:* Ensures device will operate in extreme temperature conditions

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### 4.3.4 Shock and Vibration

#### SRD-USDOTOBE-003-ReqSYS010v001 Shock and Vibration in a Moving Vehicle

**Description:** The onboard equipment device shall withstand typical shock and vibration from usage on moving vehicles.

*Reference:* SAE J1211

*Purpose:* Ensures device can operate in a moving vehicle

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### SRD-USDOTOBE-003-ReqSYS011v001 Shock and Vibration Due to Shipping

**Description:** The onboard equipment device shall withstand typical shock and vibration from normal shipping and handling.

*Reference:* SAE J1211

*Purpose:* Ensures device can survive shipping from the manufacturer to the designated shipping location.

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*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### 4.3.5 Electrostatic Discharge

#### SRD-USDOBE-003-ReqSYS012v001 Device Electrostatic Discharge

**Description:** The onboard equipment device shall be protected from typical electrostatic discharges.

*Reference:* SAE J551

*Purpose:* Ensures device can withstand ESD

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### SRD-USDOBE-003-ReqSYS013v001 Removable Storage Electrostatic Discharge

**Description:** Any removable storage equipped in an onboard equipment device shall be protected from typical electrostatic discharges.

*Reference:* SAE J551

*Purpose:* Ensures removable storage can withstand ESD


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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### 4.3.6 Conducted Electrical Transients

#### SRD-USDOBE-003-ReqSYS014v001 Conducted Power Lead Transients

**Description:** Any device input connected to a vehicle's electrical power sources will be subjected to transient conditions including low voltage conditions during engine cranking, and various higher-voltages transients that occur.

**Reference:** SAE J1113 Immunity to Conducted Transients on Power Leads

**Purpose:** Ensures device can withstand expected power lead transients.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### SRD-USDOBE-003-ReqSYS015v001 Reversed Battery Leads

**Description:** Any device input connected to a vehicle's electrical power sources will be subjected to a reversed battery lead condition.

**Reference:** None

**Purpose:** Ensures device can withstand expected reversed battery leads.

**Disposition:** Mandatory


**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

## 5 FUNCTIONAL REQUIREMENTS

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## 5.1 Interface Requirements

The vehicle awareness device shall meet all of the indicated requirements listed within this section.

### SRD-USDOBE-003-ReqINT001v001 Vehicle Interface

**Description:** The onboard equipment device shall connect to the Vehicle's power source using a Delphi Micro HVT connector (see Appendix A, Figures 3.0, and 3.1).

**Reference:** Appendix A and SAE J2922

**Purpose:** Enables device to be powered from the vehicles power source including a Hot-at-all-Time battery feed, a switched battery feed, and a Ground. Note: The vehicle-side of the connector pair will be provided; the vehicle awareness device manufacturer need only provide the device-side of the connector pair.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Inspection

### SRD-USDOBE-003-ReqINT002v001 Vehicle Interface – Vehicle Data Bus

**Description:** The onboard equipment device shall populate the Basic Safety Message with data from a vehicle data bus using the Vehicle Interface.

**Reference:** None

**Purpose:** Enables device to populate the Basic Safety Message with “live” vehicle data

**Disposition:** Optional


**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOBE-003-ReqINT003v001 Local Systems Interface (LSI)

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**Description:** The onboard equipment device shall provide at least two of the following (non-DSRC) communications interfaces/mechanisms, one from Category A and one from Category B. (Only two interfaces are needed. More interfaces can be implemented at the device maker's discretion)

Category A

- USB Port
- Ethernet Port
- Wi-Fi Port
- WiMAX (non-mobile) Port

Category B

- Removable storage (e.g. SD Card)

*Reference:* None

*Purpose:* Supports non-DSRC access for configuration and maintenance; and exchange of management data to and from the device

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### SRD-USDOTVAD-003-ReqINT001v001 DSRC Radio Interface

**Description:** The onboard equipment device shall implement one (1) 5.9GHz DSRC radio as called out in IEEE 802.11p and IEEE 1609.

*Reference:* None

*Purpose:* Support for V2V and V2I communications.

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Inspection

#### SRD-USDOTOBE-003-ReqINT004v001 DSRC Radio Interface

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**Description:** If external antennae are used, the onboard equipment device shall connect to the antennae using a USCAR18 FAKRA SMB connector male type Z for 5.9GHz DSRC and male type C for GPS (see Appendix A, Figures 3.2, and 3.3).

**Reference:** Appendix A and USCAR18-2

**Purpose:** Enables device be connected to external antennae reliably.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Inspection

## 5.2 Operations, Monitoring and Control

The vehicle awareness device shall meet all of the indicated requirements listed within this section.

### 5.2.1 Operational States

For an overview of the following requirements, please refer to the operational state diagram (Figure 1.0) in Section 3.2

#### SRD-USDOTOBE-003-ReqOMC001v001 State Transition - Initial to Operate

**Description:** The onboard equipment device shall perform a state transition from the Initial State to Operate State when first activated at time of manufacture.

**Reference:** None

**Purpose:** State transition handling the first time the device is activated.


**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

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### SRD-USDOTOBE-003-ReqOMC002v001 State Transition - Operate to Quiet

**Description:** The onboard equipment device shall perform a state transition from Operate State to Quiet State when the ignition state determined from the switched battery feed or a bus message transitions to “Off”.

*Reference:* None

*Purpose:* State transition handling when the vehicle operator intends to shut down the vehicle.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqOMC003v001 State Transition - Operate to Halt

**Description:** The onboard equipment device shall perform a state transition from Operate State to Halt State in response to an Authorized Entity’s “Halt” command.

*Reference:* None

*Purpose:* State transition handling. Note: Devices that use a removable storage device as the Local System Interface must provide instructions on when the device can be safely removed from the device.

*Disposition:* Mandatory for Category A LSI, Optional for Category B LSI

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqOMC004v001 State Transition - Operate to No Power

**Description:** The onboard equipment device shall perform a state transition from Operate State to No Power State upon loss of power.

*Reference:* None

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*Purpose:* State transition handling when an unintended power loss is experienced.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC005v001 State Transition - Quiet to No Power**

**Description:** The onboard equipment device shall perform a state transition from Quiet State to No Power State upon loss of power.

*Reference:* None

*Purpose:* State transition handling when an unintended power loss is experienced.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC006v001 State Transition - Quiet to Operate**

**Description:** The onboard equipment device shall perform a state transition from Quiet State to Operate State when the ignition state determined from the switched battery feed or a bus message transitions to “On”.


*Reference:* None

*Purpose:* State transition handling when the vehicle operator intends to operate the vehicle.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqOMC007v001 State Transition - No Power to Operate**

**Description:** The onboard equipment device shall perform a state transition from No Power State to Operate State upon return of power.

*Reference:* None

*Purpose:* State transition handling when power is restored after an unintended loss.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqOMC008v001 State Transition - Halt to Operate**

**Description:** The onboard equipment device shall perform a state transition from Halt State to Operate State in response to an Authorized Entity's "Run" command.

*Reference:* None

*Purpose:* State transition handling

*Disposition:* Mandatory for Category A LSI, Optional for Category B LSI

*Performance*


*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqOMC009v001 State Transition - Halt to No Power**

**Description:** The onboard equipment device shall perform a state transition from Halt State to No Power State upon loss of power.

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*Reference:* None

*Purpose:* State transition handling when an unintended power loss is experienced.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC010v001 Device Shutdown Time**

**Description:** The onboard equipment device shall enter the Quiet State no more than 15 minutes after ignition state transitions to “Off”.

*Reference:* None

*Purpose:* Enables device to continue transmitting when\if vehicle is disabled.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC011v001 Device Startup Time**

**Description:** The onboard equipment device shall enter the Operate State no more than 10 seconds after ignition state transitions to “On”.


*Reference:* None

*Purpose:* Enables device to operate rapidly upon vehicle start-up.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

## 5.2.2 Operational Configuration

### SRD-USDOTOBE-003-ReqOMC012v001 Device Software/Firmware

**Description:** The onboard equipment device shall execute its currently installed, uniquely identified (number, name) software/firmware.

*Reference:* None

*Purpose:* Enables device operation.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqOMC013v001 Device Configuration

**Description:** The onboard equipment device shall operate using the currently stored configuration parameters.

*Reference:* None

*Purpose:* Enables flexible and adaptable device operation.

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqOMC014v001 Configuration Storage

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**Description:** The onboard equipment device shall store all configuration parameters identified in other requirements in a uniquely identified (number, name) configuration file (hereinafter referred to as the Configuration File, described in Appendix B).

*Reference:* None

*Purpose:* Provides mechanism to change device setup. Configurable parameters will be discussed in the appropriate requirements throughout the document.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC015v001 Configuration Default**

**Description:** The onboard equipment device shall have a default value defined for each configuration parameter in the Configuration File.

*Reference:* None

*Purpose:* Support operations by providing default operational configuration values.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### **SRD-USDOTOBE-003-ReqOMC016v001 Configuration Review**

**Description:** The onboard equipment device shall enable, when the device is in Halt State, an authorized entity to view (via the LSI) the value of any configuration parameter in the Configuration File.

*Reference:* None

*Purpose:* Enables (local) review of the contents of the currently loaded Configuration File.

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Disposition: Mandatory for Category A LSI, Optional for Category B LSI.

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqOMC017v001 Configuration Modification**

**Description:** The onboard equipment device shall enable, when the device is in Halt State, an authorized entity to update (via the LSI) the value of any configuration parameter in the Configuration File.

Reference: None

*Purpose:* Enables (local) modification of the contents of the currently loaded Configuration File.

Disposition: Mandatory for Category A LSI, Optional for Category B LSI.

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqOMC018v001 Configuration Modification Validation**

**Description:** The onboard equipment device shall validate each attempted change to the value of any configuration parameter in the Configuration File to make sure that the proposed value is appropriate.

Reference: None

*Purpose:* Prevents setting an invalid value for a configuration parameter in the Configuration File.


Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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### SRD-USDOTOBE-003-ReqOMC019v001 Configuration Upload

**Description:** The onboard equipment device shall enable, when the device is in Halt State, an authorized entity to upload (via the LSI) the device's Configuration File.

**Reference:** None

**Purpose:** Enables uploading of the Configuration File from the device for archiving, maintenance or troubleshooting.

**Disposition:** Mandatory for Category A LSI, Optional for Category B LSI.

*Performance*

**Criteria:** Pass\Fail

*Verification*

**Method:** Test

### SRD-USDOTOBE-003-ReqOMC020v001 Configuration Download

**Description:** The onboard equipment device shall enable, when the device is in Halt State, an authorized entity to download (via the LSI) a Configuration File for the device.

**Reference:** None

**Purpose:** Enables downloading of Configuration File onto the device for initial configuration, maintenance or troubleshooting.

**Disposition:** Mandatory for Category A LSI, Optional for Category B LSI.

*Performance*

**Criteria:** Pass\Fail

*Verification*


**Method:** Test

### SRD-USDOTOBE-003-ReqOMC021v001 Configuration Download Validation

**Description:** The onboard equipment device shall not accept any (downloaded) configuration file with an invalid value of any configuration parameter in the Configuration File.

**Reference:** None

**Purpose:** Prevents downloading of an incomplete, faulty or corrupt Configuration File onto the device.

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

#### SRD-USDOBE-003-ReqOMC022v001 Configured Operations

**Description:** The onboard equipment device shall, when in Operate mode, operate using the currently stored operational configuration values.

*Reference:* None

*Purpose:* Enables flexible and adaptable device operation.

*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### 5.2.3 Transmitted Message Log

#### SRD-USDOTVAD-003-ReqTML001v001 System Message Storage

**Description:** The vehicle awareness device shall accept and store messages generated by internal components in formatted files generically called Transmitted Message Log (TML).


*Reference:* None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

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*Verification*

Method: Test

**SRD-USDOTVAD-003-ReqTML002v001 System Message Timestamp**

**Description:** The Vehicle Awareness Device shall ensure that each logged message contains a UTC date and timestamp for each logged message. (i.e. transmitted 802.11p frames).

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTVAD-003-ReqTML003v001 Transmitted Message Log Time Threshold**

**Description:** The Vehicle Awareness Device shall close the active TML file when configurable time threshold (default to no time limit) is reached.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory


*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTVAD-003-ReqTML004v001 Transmitted Message Log Size Threshold**

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**Description:** The Vehicle Awareness Device shall close the active TML file when configurable size threshold (default to no size limit) is reached.

Reference: None

*Purpose:* Enables efficient access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

#### **SRD-USDO TVAD-003-ReqTML005v001 Transmitted Message Log Close when Halted**

**Description:** The Vehicle Awareness Device shall close the active TML file when transitioning to a “Halt” state.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*


Method: Test

#### **SRD-USDO TVAD-003-ReqTML006v001 Transmitted Message Log Creation**

**Description:** The Vehicle Awareness Device shall create and use a new active TML file upon closing the previously active TML file.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDO TVAD-003-ReqTML007v001 Transmitted Message Log Filename**

**Description:** The Vehicle Awareness Device shall create TML files with unique filenames consisting of a UTC date-stamp and a sequence number.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDO TVAD-003-ReqTML008v001 Transmitted Message Log Retention**

**Description:** The Vehicle Awareness Device shall retain TML files indefinitely provided that sufficient storage is available.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.


Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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### SRD-USDO TVAD-003-ReqTML009v001 Transmitted Message Log Purge

**Description:** The Vehicle Awareness Device shall, if there is insufficient storage available for additional TML files or records, purge the oldest of the currently stored TML files or records until sufficient storage is made available.

**Reference:** None

**Purpose:** Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

**Disposition:** Mandatory

*Performance*

**Criteria:** Pass\Fail

*Verification*

**Method:** Test

### SRD-USDO TVAD-003-ReqTML010v001 Transmitted Message Log Access

**Description:** The Vehicle Awareness Device shall enable authorized entities to access and review TML files stored (locally) on the device.

**Reference:** None

**Purpose:** Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

**Disposition:** Mandatory

*Performance*


**Criteria:** Pass\Fail

*Verification*

**Method:** Test

### SRD-USDO TVAD-003-ReqTML011v001 Transmitted Message Log Upload

**Description:** The Vehicle Awareness Device shall enable authorized entities to transfer TML files from the device to a (remote) back end system.

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Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

#### **SRD-USDOTVAD-003-ReqTML012v001 Transmitted Message Log Deletion**

Description: The Vehicle Awareness Device shall enable authorized entities to delete TML files stored on the device.

Reference: None

*Purpose:* Enables access to information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test


#### **SRD-USDOTVAD-003-ReqTML013v001 Logging Transmitted 802.11p Frames**

**Description:** The Vehicle Awareness Device shall store all transmitted 802.11p frames in dedicated TML files.

*Reference:* None

*Purpose:* Enables comparison of messages transmitted by the device and messages received by other devices during post test analysis

*Disposition:* Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTVAD-003-ReqTML014v001 Message Log Format**

**Description:** All logged 802.11p frames shall be stored in pcap format file (using libpcap, v1.1.1 or later for UNIX based systems; or WinPcap v4.1.2 or later for Microsoft Windows based systems, or equivalent for other operating systems).

*Reference:* None

*Purpose:* Determines the format of the message in the TML.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification+++*

*Method:* Test

**SRD-USDOTVAD-003-ReqTML015v001 Transmitted Packet Log Size**

**Description:** The vehicle awareness device shall provide at least 4GB of storage space for the logging of transmitted 802.11 frames in TML files.

*Reference:* None

*Purpose:* Provides estimated file storage space for storing log data for 60 days.


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## 5.2.4 Device Positioning and Timing

### SRD-USDOTOBE-003-ReqPOS001v001 Positioning Determination Occurrence

**Description:** The onboard equipment device shall establish position of the vehicle (and qualifiers) on the surface of the earth every 100ms or at the configured transmit rate, and the time at which it was at that position.

Reference: None

*Purpose:* To determine the current vehicle position.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### SRD-USDOTOBE-003-ReqPOS002v001 Vehicle Speed

**Description:** The onboard equipment device shall derive its current vehicle speed and heading within values (currently 0.35 m/sec speed and 3 degrees heading when speed >12.5 m/sec) specified in the Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011.

Reference: Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011.

*Purpose:* To determine the current vehicle speed and heading.

Disposition: Mandatory


*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### SRD-USDOTOBE-003-ReqPOS003v001 Vehicle Position

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**Description:** The onboard equipment device shall derive its current vehicle position and time at that position within values (currently 1.5m longitude, 1.5m latitude, and 3.0m elevation) specified in the Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011.

**Purpose:** To make vehicle speed and position data available for device applications.

**Disposition:** Mandatory

*Performance*

**Criteria:** Pass\Fail

*Verification*

**Method:** Test

#### **SRD-USDOBE-003-ReqPOS004v001 Positioning Failure Handling**

**Description:** The onboard equipment device shall use a proper null value in transmitted messages should it not be able to determine its current position.

**Reference:** SAE J2735 2009-11

**Purpose:** To facilitate diagnostics and troubleshooting.

**Disposition:** Mandatory

*Performance*

**Criteria:** Pass\Fail

*Verification*


**Method:** Test

#### **SRD-USDOBE-003-ReqPOS005v001 Positioning Corrections**

**Description:** The onboard equipment device shall, for any device using a GPS receiver as part of its positioning service, be configurable (default to ON) to use WAAS corrections.

**Reference:** None

**Purpose:** To increase the accuracy of positioning information.

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Inspection

**SRD-USDOBE-003-ReqPOS006v001 System Timing Source**

**Description:** The onboard equipment device shall maintain a system clock based on timing information from the GPS receiver.

Reference: None

*Purpose:* To increase the accuracy of timing information.

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOBE-003-ReqPOS007v001 System Time Standard**

**Description:** The onboard equipment device shall conform to the Universal Time, Coordinated (UTC) standard.

Reference: ITU-R Recommendation TF.460-4: Standard-frequency and time-signal emissions. International Telecommunication Union, Annex I.

*Purpose:* Standards conformance.


Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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## 5.2.5 Device Security

This section of the specification contains the requirements securing the device and controlling access to the device. Please note that the requirements relating to security of DSRC communications are located in a separate section (5.3.5) of the document.

### SRD-USDOTOBE-003-ReqSEC001v001 Communications Interface Access Control

**Description:** The onboard equipment device shall maintain access control (e.g. configurable firewalls and ACLs) for each non-DSRC communications interface configured for IP.

**Reference:** None

**Purpose:** Enables device security while providing access for authorized entities in support of operations and maintenance.

**Disposition:** Mandatory

#### *Performance*

**Criteria:** Pass\Fail

#### *Verification*

**Method:** Test

### SRD-USDOTOBE-003-ReqSEC002v001 Secure non-DSRC Communications


**Description:** The onboard equipment device shall support at least one of the following secure access mechanisms for each non-DSRC communications interface configured for IP.

- Transport Layer Security (TLS) v1.2
- Internet Protocol Security (IPSec) for IPv4
- Internet Protocol Security (IPSec) for IPv6
- Secure Shell, v2 (SSH-2)
- SSH File Transfer Protocol v6.

**Reference:** None

**Purpose:** Enables secure communications over IP enabled (non-DSRC) links in support of operations and maintenance.

**Disposition:** Mandatory

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*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

## 5.3 DSRC Radio Subsystem

### 5.3.1 FCC Compliance

#### SRD-USDOTOBE-003-ReqDRS001v001 FCC Regulation 47 CFR Compliance for DSRC

**Description:** The onboard equipment device shall comply with Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, and 95 amendments for Dedicated Short Range Communications (DSRC), mask/class type C.

**Reference:** Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, and 95 amendments for Dedicated Short Range Communications Services and Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Service in the 5.850-5.925 GHz Band (5.9 GHz Band).

**Purpose:** FCC Compliance

**Disposition:** Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### 5.3.2 Radio Count


#### SRD-USDOTVAD-001-ReqDRS001v001 Number of DSRC Radios

**Description:** The vehicle awareness device shall support a radio configured to operate on a single channel in the 5.9GHz (DSRC) band.

**Reference:** None

**Purpose:** DSRC radio coverage and performance.

**Disposition:** Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### 5.3.3 IEEE 802.11

#### SRD-USDOTOBE-003-ReqDRS002v001 IEEE 802.11 Conformance

**Description:** The onboard equipment device shall conform to IEEE Std. 802.11-2007

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### SRD-USDOTOBE-003-ReqDRS003v001 IEEE 802.11 Physical Layer

**Description:** The onboard equipment device shall implement options defined in Clause 17 of IEEE 802.11-2007, unless otherwise indicated (including all data rates in 17.2.3.3).

*Reference:* IEEE 802.11-2007, Clause 17

*Purpose:* Standards Conformance


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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### SRD-USDOTOBE-003-ReqDRS004v001 IEEE 802.11 Modulation Scheme

**Description:** The onboard equipment device shall implement the Orthogonal Frequency-Division Multiplexing (OFDM) physical layer of the Open Systems Interconnection (OSI) model.

*Reference:* IEEE 802.11-2007, Clause 17

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

### SRD-USDOTOBE-003-ReqDRS005v001 IEEE 802.11 Default Values

**Description:** The onboard equipment device shall use the default values defined in IEEE 802.11-2007 unless otherwise indicated (including the coverage class in 17.3.8.6).

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

### SRD-USDOTOBE-003-ReqDRS006v001 IEEE 802.11 Quality of Service

**Description:** The onboard equipment device shall send 802.11 data frames using the Quality of Service (QoS) Data subtype.

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance

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*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS007v001 Arbitration Interframe Spacing Value**

**Description:** The onboard equipment device shall configure an AIFS of a given access category with an integer value from 2 to X, where the value of X is based on the chip set used – as defined by the vendor.

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS008v001 Transmission Opportunity Value**

**Description:** The onboard equipment's IEEE 802.11 TXOP Limit of a given AC shall be capable of being set to 0.

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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#### SRD-USDOBE-003-ReqDRS009v001 Contention Window Minimum Value

**Description:** The onboard equipment's IEEE 802.11 CWmin of a given AC shall take any value of the form  $(2^k)-1$ , for  $k = 1$  through  $Y$ , where the value of  $Y$  is based on the chip set used – as defined by the vendor.

*Reference:* IEEE 802.11-2007

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### 5.3.4 IEEE 802.11p

#### SRD-USDOBE-003-ReqDRS010v001 IEEE 802.11p Conformance

**Description:** The onboard equipment device shall conform to IEEE 802.11p-2010.

*Reference:* IEEE 802.11p-Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

#### SRD-USDOBE-003-ReqDRS011v001 IEEE 802.11p Basic Service Set

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**Description:** The onboard equipment device shall send MAC Protocol data units (MPDUs) outside the context of a basic service set (BSS), i.e. with the Management Information Base (MIB) variable dot11OCBEnabled set to "true".

**Reference:** IEEE 802.11p-Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

**Purpose:** Standards Conformance

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqDRS012v001 IEEE 802.11p Regulatory Class 17**

**Description:** The onboard equipment device shall support Regulatory class 17 (even 10 MHz channels in the range 172 to 184).

**Reference:** IEEE 802.11p-Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

**Purpose:** Standards Conformance

**Disposition:** Mandatory

**Performance**


**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqDRS013v001 IEEE 802.11p Regulatory Class 18**

**Description:** The onboard equipment device shall support Regulatory class 18 (odd 20 MHz channels 173 and 181).

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*Reference:* IEEE 802.11p-Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS014v001 IEEE 802.11p Enhanced Distributed Channel Access**

**Description:** The onboard equipment device shall have a configurable EDCA parameter set. By default, the EDCA parameter set is the default set defined in IEEE 802.11p-2010, Table 7-37a.

*Reference:* IEEE 802.11p -Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*


*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS015v001 IEEE 802.11p Option Enhanced Receiver Performance**

**Description:** For each implemented modulation and coding combination, the onboard equipment device supplier shall indicate if the vehicle awareness device supports the Optional Enhanced receiver performance requirements (both for adjacent and non-adjacent rejection) defined in IEEE 802.11p-2010, Table 17-13a.

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*Reference:* IEEE 802.11p-Standard for Information Technology-Telecommunications and Information Exchange between systems-Local and Metropolitan Networks-Specific Requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicle Environments, Amendment 6, Published in 2010

*Purpose:* Standards Conformance

*Disposition:* Optional

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### 5.3.5 IEEE 1609.2

#### SRD-USDOBE-003-ReqDRS016v001 IEEE 1609.2 Conformance

**Description:** The onboard equipment device shall conform to IEEE P1609.2, Draft 9, posted as 1609.2-v2-d9-2011-05.

*Reference:* IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9\_3-2011-09.

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### SRD-USDOBE-003-ReqDRS017v001 IEEE 1609.2 Security Profile

**Description:** The onboard equipment device shall comply with the 1609.2 Security Profile as defined in Appendix C of this specification.

*Reference:* Appendix C

*Purpose:* Streamline secure communications processing.

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTVAD-003-ReqDRS002v001 IEEE 1609.2 Certificates**

**Description:** The vehicle awareness device shall be able to simultaneously store at least twenty thousand (200,000) 1609.2 certificates.

*Reference:* IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9\_3-2011-09.

*Purpose:* Store sufficient security credentials to support 5 minute life span (with 30 second overlap) for at approximately two (2) years (12/hr x 24 hr/day x 2 years).

*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqDRS018v001 IEEE 1609.2 Time-Limited Certificates**

**Description:** The onboard equipment device shall make use of time-limited 1609.2 certificates, with a start and end time.

*Reference:* IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9\_3-2011-09, Security Profile Appendix C.

*Purpose:* Standards Conformance


*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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### SRD-USDOTOBE-003-ReqDRS019v001 IEEE 1609.2 Certificate Deletion upon Expiration

**Description:** The onboard equipment device shall delete expired 1609.2 certificates.

*Reference:* None

*Purpose:* Efficient use of device storage.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS020v001 IEEE 1609.2 Certificate Deletion

**Description:** The onboard equipment device shall enable the deletion of stored 1609.2 certificates by an authorized entity via the LSI when in “Halt” mode.

*Reference:* None

*Purpose:* Support for 1609.2 operations.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

### SRD-USDOTVAD-003-ReqDRS003v001 IEEE 1609.2 Certificate Reload

**Description:** The vehicle awareness device shall enable the re-load of new certificates by an authorized entity via the LSI when in “Halt” mode.

*Reference:* None

*Purpose:* Support for 1609.2 operations.

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*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS021v001 IEEE 1609.2 Static Certificate while in an Event Condition**

**Description:** The onboard equipment device shall not change its certificate while a SAE J2735-200911 defined event condition exists unless the event lasts longer than the overlap period between certificates.

*Reference:* None

*Purpose:* Maintain Device identity while in an Event Condition

*Disposition:* Optional

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS022v001 Randomize MAC Addresses on Certificate Change**

**Description:** The onboard equipment device shall randomize the DSRC radio's MAC Addresses upon a change of 1609.2 Certificate.

*Reference:* None

*Purpose:* Device Anonymity


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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### SRD-USDOTVAD-003-ReqDRS004v001 Inbound Message Non-Authentication

**Description:** The vehicle awareness device shall not authenticate incoming WAVE messages.

**Reference:** None

**Purpose:** Enables data integrity and security.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOTOBE-003-ReqDRS023v001 Inbound Message Acceptance

**Description:** The onboard equipment device shall accept all incoming WAVE messages received by the DSRC radio (whether signed or not signed).

**Reference:** None

**Purpose:** Streamline secure communications processing.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**


**Method:** Test

## 5.3.6 IEEE 1609.3

### SRD-USDOTOBE-003-ReqDRS024v001 IEEE 1609.3 Conformance

- Description:** The onboard equipment device shall conform with IEEE 1609.3-2010, August 2010

**Reference:** IEEE 1609.3-2010

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*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTVAD-003-ReqDRS005v001 IEEE 1609.3 WSMP**

**Description:** The vehicle awareness device shall transmit WAVE Short Message Protocol (WSMP) messages.

*Reference:* IEEE 1609.3-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTBE-003-ReqDRS025v001 IEEE 1609.3 Send Basic Safety Messages as WSMP**

**Description:** The onboard equipment device shall send Basic Safety Messages within WAVE Short Messages.

*Reference:* IEEE 1609.3-2010

*Purpose:* Standards Conformance


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

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### SRD-USDOTOBE-003-ReqDRS026v001 IEEE 1609.3 Safety Supplement

**Description:** The onboard equipment device shall support the transmission of the WSMP Safety Supplement specified in Annex G of IEEE 1609.3-2010.

*Reference:* IEEE 1609.3-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS027v001 IEEE 1609.3 WSMP-S Control Field

**Description:** The onboard equipment device shall be capable of sending a configured WSMP-S Control Field (default value 0x01).

*Reference:* IEEE 1609.3-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS028v001 IEEE 1609.3 PSID-Specific User Priority

**Description:** The onboard equipment device shall assign a configurable PSID value (to the value specified for the associated application area defined in IEEE 1609.12-D2, default to “0x20”) and a configurable User Priority value (default to 2) to each data frame.

*Reference:* IEEE 1609.3-2010, IEEE P1609.12-D2

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*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test\Device Test

#### SRD-USDOTOBE-003-ReqDRS029v001 IEEE 1609.3 WSMP Header Options

**Description:** The onboard equipment device shall support the following WSM header options, as part of the configuration file:

- Data Rate
- Transmit Power Used

*Reference:* IEEE 1609.3-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test\Device Test

#### SRD-USDOTOBE-003-ReqDRS030v001 WSMP Congestion Controlled Transmission Rate

**Description:** The onboard equipment device shall transmit WSMs as per the current congestion control algorithm.


*Reference:* None

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqDRS031v001 IP Firewall Rules**

**Description:** The onboard equipment device shall comply with the IP Firewall Rules as defined in Appendix D of this specification for all DSRC Radios.

*Reference:* None

*Purpose:* Secure IP Communications

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**5.3.7 IEEE 1609.4**

**SRD-USDOTOBE-003-ReqDRS032v001 IEEE 1609.4 Standard Conformance**

**Description:** The onboard equipment device shall conform to IEEE 1609.4-2010 for all DSRC radios.

*Reference:* IEEE 1609.4-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqDRS033v001 IEEE 1609.4 Radio Operating Mode Support**

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**Description:** The DSRC radio in the onboard equipment device shall be capable of operating either in "continuous" (single channel) or "alternating" (Channel Switching) modes, as shown in IEEE 1609.4-2010 Figure 10, with a default mode of "continuous".

*Reference:* IEEE 1609.4-2010

*Purpose:* Turn Channel Switch mode on and off

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS034v001 Continuous Channel Mode**

**Description:** If configured for "continuous" mode, a DSRC radio in the onboard equipment device shall also be configurable to operate (send and receive messages) on any of the 10 MHz (default to Channel 172) or 20 MHz channels with no message time interval restrictions.

*Reference:* None

*Purpose:* Support for low latency safety messages (possibly faster than a 10 Hz message rate).

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS035v001 Alternating Channel Mode**

**Description:** If configured for "alternating" mode, a DSRC radio in the onboard equipment device shall be configurable to send messages either on Channel 178 during the Control Channel (CCH) interval, or on any of the 10 MHz or 20 MHz service channels (as directed by the RSU).

*Reference:* IEEE 1609.4-2010

*Purpose:* Standards Conformance

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqDRS036v001 Service Channel Interval**

**Description:** If configured for “alternating” mode, a DSRC radio in the onboard equipment device shall be configurable to switch on every SCH interval to the configured SCH.

*Reference:* IEEE 1609.4-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqDRS037v001 Randomize MAC Addresses on Device Power Up**

**Description:** The onboard equipment device shall randomize the DSRC radio media access control (MAC) Addresses upon Power-Up (i.e., when the device is turned on).

*Reference:* None

*Purpose:* Device Anonymity


*Disposition:* Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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### SRD-USDOTOBE-003-ReqDRS038v001 Service Channel MAC Address Configuration

**Description:** The onboard equipment device shall randomly generate different MAC addresses for the Service Channel (SCH).

*Reference:* None

*Purpose:* Device Anonymity

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS039v001 Control Channel MAC Address Configuration

**Description:** The onboard equipment device shall randomly generate different MAC addresses for the Control Channel (CCH).

*Reference:* None

*Purpose:* Device Anonymity

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS040v001 IEEE 1609.4 Avoid Synchronized Collision

**Description:** During the CCH interval, when in “alternating” mode, the onboard equipment device shall mitigate the synchronized collision phenomenon discussed in Annex B of IEEE 1609.4-2010.

*Reference:* IEEE 1609.4-2010

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*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### SRD-USDOTOBE-003-ReqDRS041v001 IEEE 1609.4 Readdressing Option

**Description:** The onboard equipment device shall be capable of implementing the readdressing option defined in IEEE 1609.4-2010, Clause 6.7.

*Reference:* IEEE 1609.4-2010

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

### 5.3.8 Radio Performance

#### SRD-USDOTOBE-003-ReqDRS042v001 Transmission Range

**Description:** The onboard equipment device shall transmit DSRC communication signals 360 degrees around the specified vehicle types (as called out in SRD-USDOTOBE-003-SYS002v001) throughout a range of 1m to 300m, with a maximum Packet Error Rate of 10.0%, in an open field under the following conditions:

- When transmitting in an 802.11p Regulatory class 17 (default Channels 172 or 178) channel.
- When transmitting Part 1 of the BSM
- With a BSM Transmission Rate of 10 Hz
- 6 Mbps data rate

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*Reference:* None

*Purpose:* Ensure sufficient transmission range to support multiple devices and multiple test scenarios

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqDRS043v001 Receive Range**

**Description:** The onboard equipment device shall receive DRSC communication signals 360 degrees around the specified vehicle types (as called out in SRD-USDOTOBE-003-SYS002v001) throughout a range of 1m to 300m, with a maximum Packet Error Rate of 10.0%, in an open field under the following conditions:

- When receiving in an 802.11p Regulatory class 17 (even 10 MHz channels in the range 172 to 184) channel.
- When receiving Part 1 of the BSM
- With a BSM receive rate of 10 Hz
- 6 Mbps data rate

*Reference:* None

*Purpose:* Ensure sufficient transmission range to support multiple devices and multiple test scenarios

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

### **5.3.9 Congestion Control**

#### **SRD-USDOTOBE-003-ReqDRS044v001 Congestion Control (Under Development)**

**Description:** The onboard equipment device shall support full congestion control logic as defined in the CAMP Task VSC3 Congestion Control Document.

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*Reference:* CAMP Task VSC3 Congestion Control Document

*Purpose:* Mitigate congestion during multiple device tests

*Disposition:* Optional

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOBE-003-ReqDRS045v001 Congestion Control Algorithm Loading (Under Development)**

**Description:** The onboard equipment device shall allow the loading of one (1) executable congestion control strategy as defined in CAMP Task VSC3 Congestion Control Document, while the device is in “Halt” mode. (Default: No congestion control; default transmission rates, power levels, etc.).

*Reference:* CAMP Task VSC3 Congestion Control Document

*Purpose:* Mitigate congestion during multiple tests

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### **SRD-USDOBE-003-ReqDRS046v002 Congestion Control Parameters (Under Development)**

**Description:** The onboard equipment device shall store the following default congestion control parameters upon start up:

- Operating Channel
- Default transmit power
- Default data rate
- Radio EDCA settings
- Message Rate

*Reference:* None

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*Purpose:* Set\Manipulate Congestion Control parameters.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOBE-003-ReqDRS047v001 Congestion Control Parameter Setting on Radio Startup**

**Description:** At startup, the onboard equipment device shall execute the loaded congestion control algorithm using the configured parameter values.

*Reference:* None

*Purpose:* Set\Manipulate Congestion Control parameters.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOBE-003-ReqDRS048v001 Congestion Control Indicators**


**Description:** Upon request the onboard equipment device shall provide the following Congestion Control indicators to an authorized entity.

- Receive Signal Strength (dB)
- Channel Busy Ratio (% busy)
- Transmission Data Rate (Mbps)
- Packet Error Rate (PER) as defined in CAMP VSC3 – Congestion Control Document (to be made available upon request)

*Reference:* None

*Purpose:* Enables operation of the congestion control algorithm(s)

*Disposition:* Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS049v001 Congestion Control Parameter Configuration

**Description:** The onboard equipment device shall allow an authorized entity to configure the following congestion control parameters while the device is in halt mode:

- Transmit Rate
- Power Level
- Message Rate

*Reference:* None

*Purpose:* Set\Manipulate Congestion Control parameters

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqDRS050v001 Congestion Control Stop

**Description:** The onboard equipment device shall stop execution of the loaded congestion control algorithm upon transition to Halt State.

*Reference:* None

*Purpose:* Set\Manipulate Congestion Control parameters


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## SRD-USDOTOBE-003-ReqDRS051v001 Congestion Control Start

**Description:** The onboard equipment device shall start the execution of the congestion control algorithm upon transition to Operate State.

*Reference:* None

*Purpose:* Set\Manipulate Congestion Control parameters

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## 5.4 Other Communications

### SRD-USDOTOBE-003-ReqCOM001v001 Local Systems Interface – Protocol Support

**Description:** The onboard equipment device shall implement one of the following protocol suites for any Category A LSI interface type as listed in SRD-USDOTOBE-003-ReqINT003v001.

- Internet Protocol v4 (IPv4)
- Internet Protocol v6 (IPv6)

*Reference:* None

*Purpose:* Supports local or remote access for configuration and maintenance over non-DSRC communications interface.


*Disposition:* Optional

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## SRD-USDOTRSE-003-ReqCOM002v001 Secure Non-DSRC IP Communications

**Description:** The onboard equipment device shall support at least one of the following secure access mechanisms for each non-DSRC communications interface configured for IP.

- Transport Layer Security (TLS) v1.2
- Internet Protocol Security (IPSec) for IPv4
- Internet Protocol Security (IPSec) for IPv6
- Secure Shell, v2 (SSH-2)
- SSH File Transfer Protocol v6.

*Reference:* None

*Purpose:* Enables secure communications over IP enabled (non-DSRC) links in support of operations and maintenance.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## SRD-USDOTOBE-003-ReqCOM003v001 Non-DSRC IP Firewall Rules

**Description:** The onboard equipment device shall comply with the IP Firewall Rules as defined in Appendix D of this specification for all non-DSRC IP Interfaces.

*Reference:* None

*Purpose:* Secure IP Communications

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## SRD-USDOTOBE-003-ReqCOM004v001 Secure Non-DSRC IP Communications Account Password Reset

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**Description:** All system accounts for any non-DSRC communications interfaces on the onboard equipment devices shall have resettable passwords.

**Note:** All default Passwords **must** be provided to USDOT or its designee.

*Reference:* None

*Purpose:* Enables secure communications over IP enabled (non-DSRC) links in support of operations and maintenance.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## 5.5 WSMP Message Processing

### 5.5.1 SAE J2735 Message Types

#### SRD-USDOTOBE-003-ReqMPS001v001 DSRC Basic Safety Message

**Description:** The onboard equipment device shall conform to section 5.2 - Basic Safety Message (BSM) in the Society of Automotive Engineers (SAE) Standard J2735 2009-11: Dedicated Short Range Communications (DSRC) Message Set Dictionary, including relevant specifications outlined in Annex A; implementing ASN.1 format.

*Reference:* SAE J2735 2009-11

*Purpose:* Standards Conformance. Enables interoperability by using industry standard message definitions.


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## 5.5.2 SAE J2735 Basic Safety Message Type – Details

### SRD-USDOBE-003-ReqBSM001v001 Basic Safety Message Generation

**Description:** The onboard equipment device shall generate a BSM message at its configured message rate.

*Reference:* SAE J2735 2009-11

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOBE-003- ReqBSM002v001 Basic Safety Message Transmission

**Description:** The onboard equipment device shall transmit the generated BSM over the DSRC radio interface at its configured message rate.

*Reference:* SAE J2735-200911, IEEE P1609.2, Draft 9.3, May 2011, IEEE 1609.3, August 2010, IEEE 1609.4, August 2010, IEEE 802.11-2007, and IEEE 802.11p D11.0, March 2010

*Purpose:* The purpose of the device is enable the US DOT or its agents to conduct research related to vehicle-to-vehicle communications

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

### SRD-USDOBE-003-ReqBSM003v001 Application Security Profile

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**Description:** The onboard equipment device shall use the Application Security Profile for Basic Safety Messages.

*Reference:* Appendix C.

*Purpose:* Standards Conformance

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Device Test

#### **SRD-USDOTOBE-003-ReqBSM004v001 Basic Safety Message Part I Transmission Rate**

**Description:** The Basic Safety Message Part I message transmission rate shall be configurable within the range of 2 Hz to 20 Hz with a default to 10 Hz.

*Reference:* None

*Purpose:* Congestion control

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test


#### **SRD-USDOTOBE-003-ReqBSM005v001 Basic Safety Message Part II Transmission Interval**

**Description:** The onboard equipment device shall transmit each of the required Basic Safety Message Part II data frames and data elements with every “Nth” BSM Part I message with “N” being a configurable value with a default of 10.

*Reference:* None

*Purpose:* Enables multiple Test Configurations

*Disposition:* Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqBSM006v001 Event Triggered Basic Safety Message

**Description:** The onboard equipment device shall transmit a Basic Safety Message triggered by one or more vehicle generated events as soon as possible, but within 50 ms.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Multiple Test Configurations

*Disposition:* Optional

*Performance*

*Criteria:* Pass\Fail


*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqBSM007v001 General Data Frames and Data Elements – Part 1

**Description:** The Basic Safety Message Part 1 shall include, at a minimum, the data frames and data elements listed below:

- DSRCmsgID
- MsgCount
- TemporaryID
- DSecond
- Latitude
- Longitude
- Elevation
- Positional Accuracy
- TransmissionAndSpeed::Speed
- Heading
- AccelerationSet4Way::Longitudinal Acceleration, Yaw

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*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Provides a minimum set of data for simulating real world conditions

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail. Note: Requirements for BSM values will be specified elsewhere in this specification.

*Verification*

*Method:* Device Test

### SRD-USDOTOBE-003-ReqBSM008v001 General Data Frames and Data Elements - Part II

*Description:* The Basic Safety Message Part II shall include at a minimum, the data frames and data elements listed below, subject to limitations defined in requirements elsewhere in this specification and in the Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document.

- Event Flags
- PathHistory
- PathPrediction
- Vehicle Type

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Provides a minimum set of data for simulating real world conditions

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqBSM009v001 Basic Safety Message Data Frame/Element Values

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**Description:** The onboard equipment device shall provide a means for populating all required data frames and data values as listed on SRD-USDOTOBE-003-ReqBSM007v001 and SRD-USDOTOBE-003-ReqBSM008v001 above.

*Reference:* None

*Purpose:* Enables multiple Test Configurations

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM010v001 Basic Safety Message Data Frame/Element Value Population**

**Description:** The onboard equipment device shall populate all required data frames and data values as listed on SRD-USDOTOBE-003-ReqBSM007v001 and SRD-USDOTOBE-003-ReqBSM008v001 above.

*Reference:* None

*Purpose:* Enables multiple Test Configurations

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*


*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM011v001 MsgCount DE Initialization**

**Description:** The onboard equipment device shall initialize the MsgCount field in the Basic Safety Message to any value in the range 0-127 when sending the first message with a given DSRCmsgID,

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Message Tracking and Identification

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*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM012v001 MsgCount DE Rotation on Temporary ID Change**

**Description:** The onboard equipment device shall initialize the MsgCount field in the Basic Safety Message to any value in the range 0-127 if the sender has changed identity by changing its TemporaryID since sending the most recent message with that DSRCmsgID,

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Device Anonymity

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM013v001 TemporaryID DE Rotation**

**Description:** The onboard equipment device shall assign random valid values for the TemporaryID that are not predictable.


*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Device Anonymity

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM014v001 TemporaryID DE Rotation on Certificate Change**

**Description:** The onboard equipment device shall change the TemporaryID to a random valid value when any Certificate associated with the message is changed

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Device Anonymity

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM015v001 TemporaryID DE Rotation on Reception of Same TemporaryID**

**Description:** If the onboard equipment device receives\processes Basic Safety Messages, the vehicle awareness device shall change its TemporaryID to a different random valid value when it receives a Basic Safety Message with the same TemporaryID.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Device Anonymity

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM016v001 DSecond DE Value Determination**

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**Description:** The onboard equipment device shall set the value of the DSecond data element when the BSM Part I vehicle location data is determined by the sensor source.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqBSM017v001 DSecond DE Accuracy**

**Description:** The onboard equipment device shall maintain accuracy of DSecond data element of the BSM with values within one milliseconds of UTC when the vehicle's location is determined.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail


**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqBSM018v001 Latitude DE Value**

**Description:** The onboard equipment device shall set the value of the Latitude data element of the BSM with values that are within at least within 1.5 meters of the actual latitude at an HDOP smaller than 5 under open sky conditions within the 1 sigma absolute error

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

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*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM019v001 Latitude DE Value Determination**

**Description:** The onboard equipment device shall set the value of the Latitude data element when the BSM Part I positional data is determined based on the sensor source.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM020v001 Latitude DE Value Accuracy**

**Description:** The onboard equipment device shall maintain accuracy of Latitude data element of the BSM with values within one milliseconds of UTC when the vehicle's location is determined.


*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM021v001 Longitude DE Value**

**Description:** The onboard equipment device shall set the value of the Longitude data element of the BSM with values that are within at least within 1.5 meters of the actual longitude at an HDOP smaller than 5 under open sky conditions within the 1 sigma absolute error

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM022v001 Longitude DE Value Determination**

**Description:** The onboard equipment device shall set the value of the Longitude data element when the BSM Part I positional data is determined based on the sensor source.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory, if the device receives\processes Basic Safety Messages; otherwise, Optional


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM023v001 Longitude DE Value Accuracy**

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**Description:** The onboard equipment device shall maintain accuracy of Longitude data element of the BSM with values within one milliseconds of UTC when the vehicle's location is determined.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory, if the device receives\processes Basic Safety Messages; otherwise, Optional

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqBSM024v001 Elevation DE Value**

**Description:** The onboard equipment device shall set the value of the Elevation data element of the BSM with values that are within at least within 3 meters of the actual elevation at an HDOP smaller than 5 under open sky conditions within the 1 sigma absolute error

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail


**Verification**

**Method:** Test

#### **SRD-USDOTOBE-003-ReqBSM025v001 PositionalAccuracy DF Value**

**Description:** The onboard equipment device shall set the value of the PositionalAccuracy data frame of the BSM with values most recently received from the GPS receiver.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

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*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM026v001 Speed DE Value Latency**

**Description:** The onboard equipment device shall ensure that the value of the Speed data element of the BSM has a latency of less than 220 milliseconds.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM027v001 Speed DE Value Accuracy**

**Description:** The onboard equipment device shall generate values for the Speed data element of the BSM with accuracy better than 0.35 m/sec.


*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM028v001 Heading DE Value Latency**

**Description:** The onboard equipment device shall ensure that the value of the Heading data element of the BSM has a latency of less than 220 milliseconds.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM029v001 Heading DE Value Error Tolerance**

**Description:** The onboard equipment device shall ensure that the value of the Heading data element of the BSM has an error shall be less than 3 degrees when the vehicle speed is between 0.56 m/sec and 12.5 m/sec. The error shall be less than 2 degrees when the vehicle speed is greater than 12.5m/sec.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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### SRD-USDOBE-003-ReqBSM030v001 Heading DE Value Latching

**Description:** The onboard equipment device shall, when the vehicle speed drops below 0.56 m/sec, latch the value of the Heading data element of the BSM to the last known good heading value above 0.56 m/sec.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOBE-003-ReqBSM031v001 Heading DE Value Unlatching

**Description:** The onboard equipment device shall unlatch the value of the Heading data element of the BSM when the vehicle speed exceeds 0.83m/sec.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**


**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOBE-003-ReqBSM032v001 Longitudinal Acceleration DE Value Accuracy

**Description:** The onboard equipment device shall ensure that the value of the LongitudinalAcceleration data element of the BSM has an accuracy that is less than  $0.1 \text{ m/sec}^2$ .

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*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM033v001 Longitudinal Acceleration DE Value Latency**

**Description:** The onboard equipment device shall ensure that the value of the LongitudinalAcceleration data element of the BSM has a latency of less than 220 milliseconds.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test


#### **SRD-USDOTOBE-003-ReqBSM048v001 Yaw Rate DE Value Unavailability**

**Description:** The onboard equipment device shall use the value of 32767 when the yaw rate of the vehicle is unavailable or cannot be determined.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOBE-003-ReqBSM049v001 Yaw Rate Noise DE Value**

**Description:** The onboard equipment device shall ensure that yaw rate noise shall be better than one sigma of 0.5 degree per second.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOBE-003-ReqBSM050v001 Yaw Rate Bias DE Value**

**Description:** The onboard equipment device shall ensure that the absolute value of the yaw rate bias shall be less than 0.3 degree/second.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.


**Disposition:** Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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### SRD-USDOTOBE-003-ReqBSM051v001 Yaw Rate Latency DE Value

**Description:** The onboard equipment device shall ensure that the latency of the yaw rate shall be less than 220 ms.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure that vehicle safety applications have accurate positioning and timing data.

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOTOBE-003-ReqBSM034v001 EventFlag DF Persistence

**Description:** If one or more events are active, the onboard equipment device shall include the EventFlags data frame in Basic Safety Message Part II for as long as the event(s) is active.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Multiple Test Configurations

**Disposition:** Mandatory

**Performance**


**Criteria:** Pass\Fail

**Verification**

**Method:** Test

### SRD-USDOTOBE-003-ReqBSM035v001 EventFlag DF HardBraking Event Flag

**Description:** The onboard equipment device shall set the HardBraking event flags as part of the EventFlag data frame in the BSM, Part II VehicleSafetyExtension data frame when the vehicle has decelerated or is decelerating at a rate greater than 0.4 g and only if the event duration is equal to or larger than 400 ms.

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*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Multiple Test Configurations

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM036v001 EventFlag DF HardBraking Event Flag Latency**

**Description:** The onboard equipment device shall ensure that the value of the HardBraking Event Flag data element of the BSM Part II has a latency of less than 220 milliseconds.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Ensure that vehicle safety applications have accurate positioning and timing data.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test


#### **SRD-USDOTOBE-003-ReqBSM037v001 PathHistory DF PathHistoryPointSets**

**Description:** The onboard equipment device shall populate the PathHistory data frame in the VehicleSafetyExtension part of the Basic Safety Message Part II with PathHistoryPointSets-04.

*Reference:* SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory

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*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM038v001 PathHistory Distance**

**Description:** The onboard equipment device shall populate the PathHistory data frame in the VehicleSafetyExtension part of the Basic Safety Message Part II with an adaptable number of PathHistory points so that the represented Path History distance (i.e. the distance between the first and last Path History point) is at least 300 meters.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Vehicle trajectory analysis

**Disposition:** Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM039v001 PathHistory Perpendicular Distance Difference**

**Description:** The onboard equipment device shall incorporate Path History points in the PathHistory data frame in the VehicleSafetyExtension part of the Basic Safety Message Part II such that the perpendicular distance between any point on the vehicle path and the line connecting two consecutive Path History points is less than 1 meter


**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Vehicle trajectory analysis

**Disposition:** Mandatory

*Performance*

*Criteria:* Pass\Fail

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*Verification*  
*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM040v001 PathHistory Data Source**

**Description:** The onboard equipment device shall populate the Path HistoryPoints data element in the PathHistory data frame in the VehicleSafetyExtension part of the Basic Safety Message Part II with position data elements (Latitude, Longitude, Elevation), sampled at a periodic time interval (typically, 100 ms) and interpolated in between by circular arcs, representing the recent vehicle movement over a certain distance.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory

*Performance*  
*Criteria:* Pass\Fail

*Verification*  
*Method:* Test

#### **SRD-USDOTOBE-003-ReqBSM041v001 PathHistory Conciseness**


**Description:** The onboard equipment device shall populate PathHistory data frame in the VehicleSafetyExtension part of the BSM Message Part II with a minimum number of Path History points, selected as a subset of the available vehicle path position data elements, necessary to satisfy the required error tolerance between the vehicle path and its Path History representation.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory

*Performance*  
*Criteria:* Pass\Fail

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*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM042v001 PathHistory Point Order**

**Description:** The onboard equipment device shall populate PathHistory data frame in the VehicleSafetyExtension part of the BSM Message Part II with a time ordered Path History points, with the first point being the closest in time to current UTC time.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

**SRD-USDOTOBE-003-ReqBSM043v001 PathHistory Point Maximum Count**

**Description:** The onboard equipment device shall populate PathHistory data frame in the VehicleSafetyExtension part of the BSM Message Part II with the 23 most recent among the computed set of points, if the number of Path History points needed to meet requirements stated elsewhere in this specification exceeds the maximum allowable (23) number of points specified in PathHistoryPointsSets-04, (effectively the distance requirement shall be relaxed).

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## SRD-USDOTOBE-003-ReqBSM044v001 PathPrediction DF Values

**Description:** The onboard equipment device shall include a PathPrediction data frame in the VehicleSafetyExtension data frame in each generated Basic Safety Message Part II, only if both radius and confidence values are meaningful values.

For the purposes of the Path Prediction Minimum Performance Requirements, Steady State Conditions are defined as follows: The vehicle is driving on a curve with constant radius. The average of the absolute value of the change of yaw rate over time is smaller than 0.5 deg/sec<sup>2</sup>

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Vehicle trajectory analysis

**Disposition:** Mandatory

**Performance  
Criteria:** Pass\Fail

**Verification  
Method:** Test

## SRD-USDOTOBE-003-ReqBSM045v001 PathPrediction DF Confidence

**Description:** Path Prediction Confidence shall be sent with every frame. The Path Prediction Confidence shall be calculated according to the method that is specified in a separate design document. The onboard equipment device shall not include a PathPrediction data frame in the VehicleSafetyExtension data frame in a generated Basic Safety Message Part II, if the confidence value is zero (0).


**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Vehicle trajectory analysis

**Disposition:** Mandatory

**Performance  
Criteria:** Pass\Fail

**Verification  
Method:** Test

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### SRD-USDOTOBE-003-ReqBSM046v001 PathPrediction DF Error Tolerance

*Description:* The onboard equipment device shall calculate the radiusOfCurve value with error of less than one half lane width.

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqBSM052v001 PathPrediction DF Maximum Allowable Error Bound

*Description:* The onboard equipment device shall populate the Path Prediction DF with a calculated radius which has less than 2% error rate from the actual radius (when the vehicle is in steady state conditions over a range from 100 m to 2500 m).

*Reference:* Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

*Purpose:* Vehicle trajectory analysis

*Disposition:* Mandatory


*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

### SRD-USDOTOBE-003-ReqBSM053v001 PathPrediction DF Recalculation Interval

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**Description:** The onboard equipment device shall re-populate the PathPrediction data frame after a transition from the original constant radius (R1) to the target constant radius (R2) within 4 seconds under the maximum allowable error bound defined in SRD-USDOTOBE-003-ReqBSM052v001.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Vehicle trajectory analysis

**Disposition:** Mandatory

**Performance**

**Criteria:** Pass\Fail

**Verification**

**Method:** Test

#### SRD-USDOTOBE-003-ReqBSM054v001 VehicleType DE Value Inclusion

**Description:** The onboard equipment device shall include the correct value in the VehicleType data element in the VehicleSafetyExtension data frame in each generated and sent Basic Safety Message Part II, only if VehicleWidth or VehicleLength in the BSM Part I is set to “unavailable”.

**Reference:** Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements-VSC3 Internal Document, Revision 9.0, 10/10/2011 and SAE J2735-200911

**Purpose:** Ensure vehicle type data element is included and set correctly in the BSM Part II data frame if vehicle width or vehicle length is not a meaningful value

**Disposition:** Mandatory

**Performance**


**Criteria:** Pass\Fail

**Verification**

**Method:** Test

## 6 TEST REQUIREMENTS

### 6.1 Radio Transmission

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## SRD-USDOBE-003-ReqTST001v001 Transmission Measurement

**Description:** The onboard equipment device shall support a DSRC radio transmission pattern 360 degrees around the specified vehicle types (as called out in SRD-USDOBE-003-SYS002v001) throughout a range of 1m to 300m, with a maximum Packet Error Rate of 10.0%, in an open field under the following conditions:

- When transmitting in an 802.11p Regulatory class 17 (even 10 MHz channels in the range 172 to 184) channel.
- When transmitting Part 1 of the BSM
- With a BSM Transmission Rate of 10 Hz
- 6 Mbps data rate

*Reference:* SAE J2735 2009-11/802.11p

*Purpose:* Enables common test procedures.

*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

## SRD-USDOBE-003-ReqTST002v001 Pattern Measurement Location

**Description:** Measurements of the radio transmission pattern shall be made in the middle of an open field with no man-made or natural structures that would reflect 5.9 GHz radiation within 2.5 kilometers (km) of the test vehicle(s).

*Reference:* None

*Purpose:* Enables common test procedures


*Disposition:* Mandatory

*Performance*

*Criteria:* Pass\Fail

*Verification*

*Method:* Test

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## 6.2 Vehicle Location

### SRD-USDOTOBE-003-ReqTST003v001 Data Elements Measurement - Stationary Vehicle

**Description:** The onboard equipment device shall provide vehicle location data elements of the basic safety message to within the required values of ground truth (defined as predetermined geographic coordinates for a fixed point or points in the test area) with the vehicle stationary.

Reference: None

*Purpose:* Enables common test procedures

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### SRD-USDOTOBE-003-ReqTST004v001 Data Elements Measurement – Moving Vehicle

**Description:** The onboard equipment device shall provide vehicle location data elements of the basic safety message to within required values of ground truth (defined as predetermined geographic coordinates for a fixed point or points in the test area) with the vehicle traveling at speeds of 20 and 45 mph, and in a Figure 8 pattern.

Reference: None

*Purpose:* Enables common test procedures

Disposition: Mandatory


*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

### SRD-USDOTOBE-003-ReqTST005v001 Data Elements Measurement Test Units

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**Description:** Measurements of vehicle location data elements shall be made with the vehicle stationary and with the vehicle being driven, at speeds of 20 and 45 mph, over a specified point with a known geographic location plotting 10 data points per second over 10 minute duration.

Reference: None

*Purpose:* Enables common test procedures

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

#### **SRD-USDOBE-003-ReqTST006v001 Data Elements Measurement Ground Truth Test Point**

**Description:** The location of the given ground truth points shall be established with equipment capable of measurements within 10cm of the absolute location.

Reference: None

*Purpose:* Enables common test procedures

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*


Method: Test

#### **SRD-USDOBE-003-ReqTST007v001 Data Elements Measurement Location**

**Description:** Measurements of vehicle location data elements shall be made at a location near the middle of the continental United States (CONUS), at a location with no overhead obstruction within 1 km of the given measurement point.

Reference: None

*Purpose:* Enables common test procedures

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Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqTST008v001 Data Elements Time Measurement**

**Description:** The time at which the reference equipment in the test vehicle(s) pass over the given ground truth point shall be measured using equipment capable of giving a time measurement with accuracy within 1msec UTC time.

Reference: None

*Purpose:* Enables common test procedures

Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

**SRD-USDOTOBE-003-ReqTST009v001 Data Elements Vehicle Location Measurement**

**Description:** The vehicle's reported location at the time at which it passes the ground truth point shall be calculated using a linear extrapolation assuming a constant vehicle velocity.

Reference: None

*Purpose:* Enables common test procedures


Disposition: Mandatory

*Performance*

Criteria: Pass\Fail

*Verification*

Method: Test

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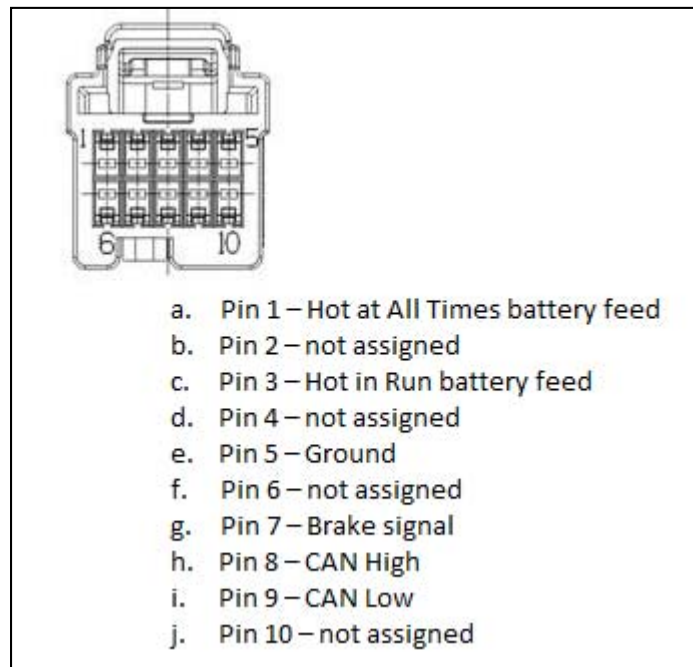
**01**

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## Appendix A: Vehicle Power Connector

The below image is for reference only. This is an image of the Delphi Micro HVT male connector looking into the cable side of the harness connector. The pin side of the header or in-line mate will have the same orientation. Pin assignments for the main power and ground are determined by the right angle header so that power and ground are on the outside corners of the in-board row of pins.



**Figure 3.0 Connector Pin Diagram**

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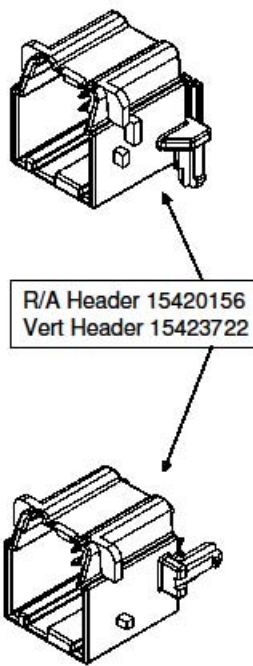
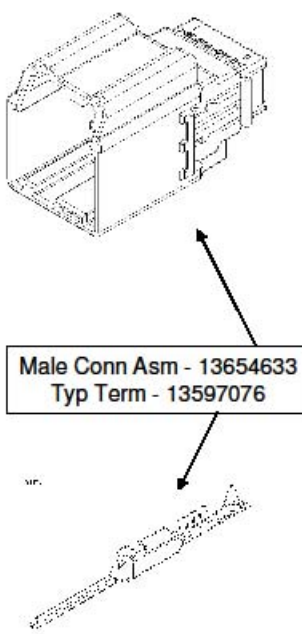
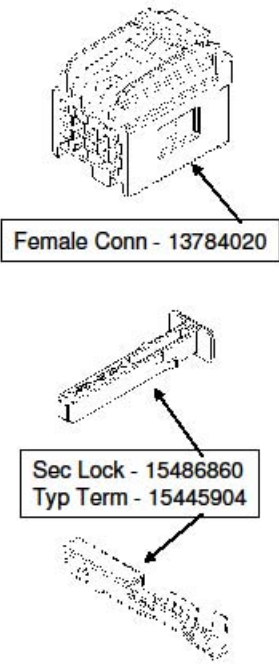
<b>Micro HVT USCAR 10-Pin Connectors</b>		
<u>Headers</u>	<u>Male In-Line Connection</u>	<u>Female Connection</u>
 <p>R/A Header 15420156 Vert Header 15423722</p>	 <p>Male Conn Asm - 13654633 Typ Term - 13597076</p>	 <p>Female Conn - 13784020</p> <p>Sec Lock - 15486860 Typ Term - 15445904</p>
As of 10JA11	Delphi Connection Systems	
		S. Felix

Figure 3.1 Connector Family

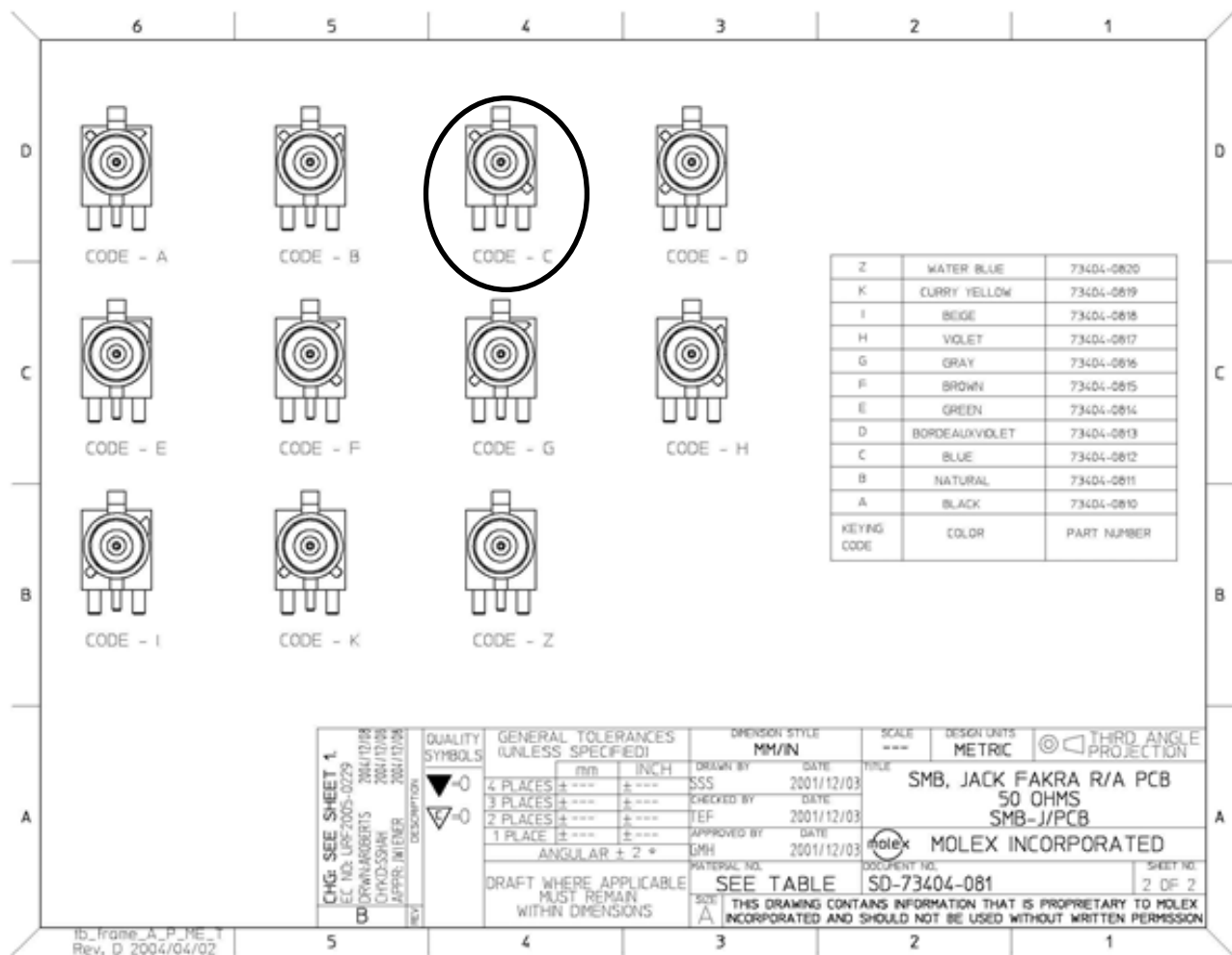


Figure 3.2 FACRA SMB Male Type C for GPS



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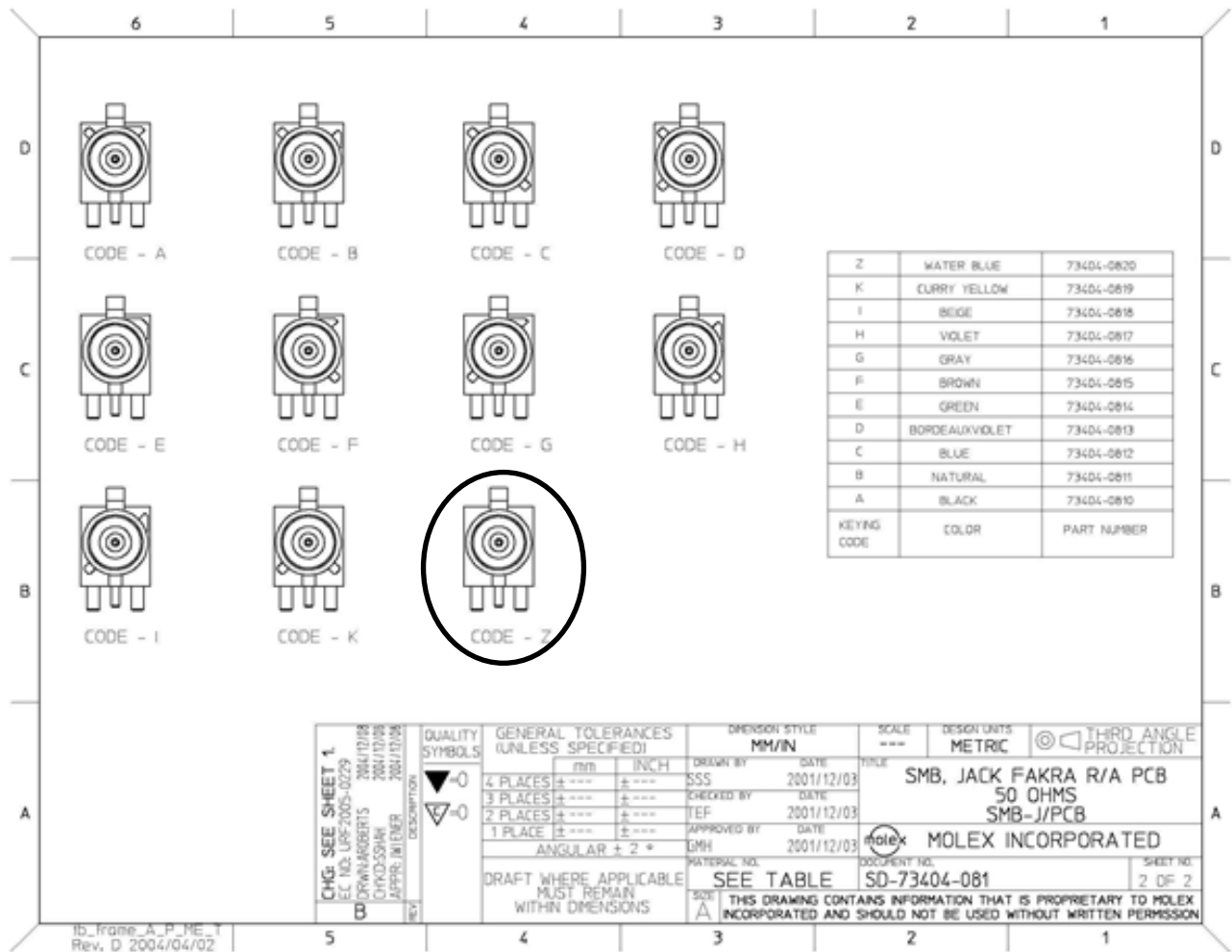



Figure 3.3 FACRA SMB Male Type Z for 5.9GHz DSRC



# Appendix B: Configuration File Format

## (Under Development)

This appendix will define the structure and format of the Configuration File to be used by all vehicle awareness devices. This structured Configuration File will identify all configuration items required for the vehicle awareness device. Each configuration item will have specified default value. The format of the Configuration File will tentatively be a CSV text file.

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# Appendix C: Security Profile


## C.1 Overall

These are the security profiles for use in Safety Pilot Model Deployment only. This document does not constitute a commitment or indication as to the security profiles for use in any other project or deployment.

### Needs

- All messages need to be signed so recipients can authenticate the source of the message. Recipients have the responsibility to determine if they trust the source.
- Signatures will be checked on messages were action results. Messages collected in log files should be included regardless of authenticity.
- The same cryptographic signature (and if needed encryption) process needs to be applied to all messages – BSM's, TIM's, SPaT's, GID's, WSA's, IP datagrams.

Refer to “5.9GHz DSRC Roadside Equipment” Device Specification, version 2.2 for complete security profiles.

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## Appendix D: Firewall Rules

This section defines the Firewall Rules for the Vehicle Awareness Device.

**Table D.1: — Protected IP Interfaces**

Interface	Purpose
DSRC Radio	Wireless communications with other DSRC enabled mobile devices and with DSRC enabled infrastructure devices.
Local System Interface	Configuration and management interface

**Table D.2: — Protected IP Interface Addressing**

Interface	Address Scope
DSRC Radio	IPv6 link-local, non-routable
Local System Interface	IPv6 link-local, non-routable
	IPv4 non-routable

**Table D.3 — Protected IP Interface Security Configuration**

Interface	Rule	Firewall Policies
DSRC Radio	Allow	<ul style="list-style-type: none"> <li>None</li> </ul>
	Deny	<ul style="list-style-type: none"> <li>All IPv4 ingress and egress traffic</li> <li>All IPv6 ingress and egress traffic</li> </ul>
Local System Interface	Allow	<p><b><u>IPv6 Rules</u></b></p> <ul style="list-style-type: none"> <li>IPv6 Traffic on Linked-Local address subnet</li> <li>Ingress IPv6 TELNET over TLS v1.2 traffic from LMD , TCP port 992</li> <li>Ingress IPSEC (for IPv6) traffic from LMD</li> <li>Ingress IPv6 Secure-Shell (SSH-2, SFTP) traffic from LMD, TCP, port 22</li> <li>Egress IPv6 traffic from Vehicle Awareness Device to LMD</li> </ul> <p><b><u>IPv4 Rules</u></b></p> <ul style="list-style-type: none"> <li>Ingress IPv4 TELNET over TLS v1.2 traffic from LMD, TCP/IP port 992</li> <li>Ingress IPSEC (for IPv4) traffic from LMD</li> <li>Ingress IPv4 Secure-Shell (SSH-2, SFTP) traffic from LMD, TCP port 22</li> <li>Egress IPv4 traffic from Vehicle Awareness Device to LMD</li> </ul>
	Deny	<ul style="list-style-type: none"> <li>All IPv4 ingress traffic except those defined in the “Allow” section</li> <li>All IPv6 ingress traffic except those defined in the “Allow” section</li> </ul>