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SYSTEM REQUIREMENT DESCRIPTION

“5.9GHz DSRC Roadside Equipment” Device Specification

Approved by (dept, name, phone) US DOT, RITA, Walton Fehr, (202) 366-0278 walton.fehr@dot.gov	Issued by (dept, name, phone) US DOT, RITA, Walton Fehr, (202) 366-0278 walton.fehr@dot.gov
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 Research and Innovative Technology Administration	Document Title: “5.9GHz DSRC Roadside Equipment” Device Specification			
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	Document No. USDOTRSE	Issue Index 3.0	Volume No. 01	

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1 INTRODUCTION

1.1 What is the purpose of this document?

This document will set the requirements for roadside equipment grade electronic module capable of acting as the first-point-of-contact device for a 5.9GHz infrastructure.

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 functional 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	11/27/2010	First Issue	Walton Fehr	Walton Fehr
001	001.1	12/08/2010	-Updated Header and Footer information -Updated Section 2.3 for grammar -Moved Section 4 (System Description) ahead of Section 3 (System Requirements) -Began developing spec for RSE requirements -Updated Section 3.1 Functional Description - (add others)	Walton Fehr	M. Marshall
002	001.2	01/07/2011	Walkthrough Updates (many)	Walton Fehr	M. Marshall J. Marousek
003	002.0	10/19/2011	1. Revised to incorporate comments received from USDOT and Device Vendors 2. Revised to align with the recently released	Walton Fehr	J. Marousek

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Rev.	Vers.	Date	Description	Approved by	Responsible
			Version 2.1 of the Aftermarket Safety Device Specification		
004	002.1	11/01/2011	<ol style="list-style-type: none"> Added content to Appendix D “Active Message File Format” Addressed comments from vendor review session. Revised requirements to not include SNMP 	Walton Fehr	J. Marousek
005	002.2	11/10/2011	<ol style="list-style-type: none"> Updated IEEE 1609.2 standard reference to latest (Draft 9.3) version. Inserted table of PSIDs into Appendix B – Security Profile Updated content of Appendix D – Active Message File Format. 	Walton Fehr	J. Marousek
006	002.3	12/01/2011	<ol style="list-style-type: none"> SRD-USDOTRSE-002-ReqOMC025v001 Heartbeat Transmission security profile added SRD-USDOTRSE-002-ReqCML003v001 Communications Message Separation by Interface default file type changed to Combined SRD-USDOTRSE-002-ReqCML018v001 CML Automated Off-Load Initiation-Time Threshold transport protocol and security profile added SRD-USDOTRSE-002-ReqPOS001v001 Positioning Determination Occurrence wording clarified, default given SRD-USDOTRSE-002-ReqOMC028v001 Heartbeat Transmission Failure deleted SRD-USDOTRSE-002-ReqDRS036v001 DSRC Radios – Default Alternating Channel Mode default Control Channel and Service Channel numbers added SRD-USDOTRSE-002-ReqDRS031v001 IEEE 1609.3 WSM Congestion Controlled Transmission Rate made optional SRD-USDOTRSE-002-ReqTCM001v001 SPaT/GID Message Configuration deleted Appendix E: Heartbeat Transmission Text String Format added 	Walton Fehr	Walton Fehr
007	3.0	03/01/2012	<ol style="list-style-type: none"> Update the reference list to reflect the latest version of the CAMP MPR specification, Replaced all references to the CAMP Security Design Specification with a reference to the USDOT Security Credential Management System Design Specification Added a RSE State Definition Table adjacent to Figure 1 – Roadside Equipment State Diagram 	Walton Fehr	J. Marousek

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Rev.	Vers.	Date	Description	Approved by	Responsible
			4. Removed the contents of Appendix B – Security Profile and replace it with a reference to the USDOT SCMS Design Specification. 5. Minor formatting change to the Table C.3 in Appendix C – Firewall Rules 6. Incorporated Spat and Map message examples into Appendix D. 7. Added Appendix F – Log File Transfer Protocol		

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:

#	Reference
1.	CAMP Task VSC3 Congestion Control Document (available upon request)
2.	CAMP VSC3 – Model Deployment Safety Device DSRC BSM Communication Minimum Performance Requirements, Revision 11.1, 1/24/2012 (available upon request)
3.	USDOT Security Credential Management System Design, February 29, 2012
4.	Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, 90, 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).
5.	IEEE 802.11-2007
6.	IEEE P1609.12, Draft 0.5
7.	IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9_3-2011-09
8.	IEEE 1609.3-2010, August 2010
9.	IEEE 1609.4-2010, August 2010
10.	IEEE 802-802.11p-2010
11.	ITE/NEMA standards for electronic equipment installed at the edge of a roadway.
12.	MIL-STD-810 G: Department Of Defense Test Method Standard: Environmental Engineering Considerations and Laboratory Tests, OCT 31, 2008
13.	NEMA TS2-2003 v02.06
14.	SAE J1113: Electromagnetic Compatibility Measurement Procedure for Vehicle Component
15.	SAE J1211: Handbook for Robustness Validation of Automotive Electrical/Electronic Modules
16.	SAE J2735 2009-11: Dedicated Short Range Communication (DSRC) Message Set Dictionary
17.	SAE J551: Vehicle Electromagnetic Immunity – Electrostatic Discharge
18.	USDOT DTFH61-11-RA-00003 Solicitation Appendix B. System Level Test Procedures

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2 TERMINOLOGY

2.1 Definitions

Definition	Description
Alternating Mode	The device switches between the Control Channel and the Service Channel
Authorized Entity	An external entity (person or software application) that obtained the proper credentials and subsequently uses these credentials to gain access the device to perform one or more authorized actions or operations.
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 device does not switch radio channels. It only uses 1 channel
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.
Multiple Channel	The device uses multiple channels and can switch radio channels.
Non-DSRC	Communications protocol outside of the 5.9GHz DSRC band
Process	To perform useful operations on data or executing a program
Public Key	Part of a mathematically related public/private key pair, and used to digitally sign and / or encrypt electronic messages or documents.
Radio Set	A 5.9GHz DSRC radio or radios capable of operating on two channels simultaneously as called out in IEEE 802.11p and IEEE 1609. If dual radios are used, then the pair are logically coupled into a single cohesive Radio Set.
Service and Maintenance	TBD
Sign	Digitally signing a electronic message or document using
System Log Message	A descriptive message created by a system component which identifies an activity or event of note.
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

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2.2.1 Identification of Requirements

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

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

Field	Content Description																								
document type	This is a constant text string set to “SRD”, which is an acronym for “System Requirements Description”																								
system	This is a constant text string set to “USDOTRSE”.																								
issue number	This is set to the current issue number of this Systems Requirements Description.																								
requirement section	This is set to the functional category of the requirement and will be one of the following: <table border="1"> <tbody> <tr> <td>BSM</td> <td>Basic Safety Messaging</td> </tr> <tr> <td>CML</td> <td>Communications Message Log</td> </tr> <tr> <td>COM</td> <td>Communications</td> </tr> <tr> <td>DRS</td> <td>DSRC Radio Services</td> </tr> <tr> <td>IPM</td> <td>IP Messaging</td> </tr> <tr> <td>MSG</td> <td>Messaging</td> </tr> <tr> <td>OMC</td> <td>Operations, Management & Control</td> </tr> <tr> <td>POS</td> <td>Positioning</td> </tr> <tr> <td>SAR</td> <td>Store and Replay Messaging</td> </tr> <tr> <td>SEC</td> <td>Security</td> </tr> <tr> <td>SYS</td> <td>System</td> </tr> <tr> <td>TCM</td> <td>Traffic Controller Messaging</td> </tr> </tbody> </table>	BSM	Basic Safety Messaging	CML	Communications Message Log	COM	Communications	DRS	DSRC Radio Services	IPM	IP Messaging	MSG	Messaging	OMC	Operations, Management & Control	POS	Positioning	SAR	Store and Replay Messaging	SEC	Security	SYS	System	TCM	Traffic Controller Messaging
BSM	Basic Safety Messaging																								
CML	Communications Message Log																								
COM	Communications																								
DRS	DSRC Radio Services																								
IPM	IP Messaging																								
MSG	Messaging																								
OMC	Operations, Management & Control																								
POS	Positioning																								
SAR	Store and Replay Messaging																								
SEC	Security																								
SYS	System																								
TCM	Traffic Controller Messaging																								
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 requirement section (see above).																								
requirement version number	This is set to the current version number of the individual requirement.																								

The following examples illustrate the requirement nomenclature used within this SRD:

SRD-USDOTRSE-002-ReqSYS004v001

This requirement was introduced in the first issue of the SRD for system USDOTRSE. It is the fourth requirement in the System Requirements section within the document and it is the first version of the requirement.

SRD-USDOTRSE-003-ReqDRS001v002

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This requirement was updated in the third issue of the SRD for system USDOTRSE. It is the first requirement in the DSRC Radio Subsystem Requirements section within the document and it has been updated to a second version.

SRD-USDOTRSE-003-ReqTST009v001

This requirement was introduced in the third version of the SRD for system USDOTRSE. It is the ninth requirement in the Test Requirement section within the document and it is the first version of the requirement.

2.3 Abbreviations and Definitions

Abbr.	Description	Definition
AC	Access Category	See IEEE 802.11-2007
AC	Alternating Current	
ACL	Access Communications Link	
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.
BSM	Basic Safety Message	
C	Celsius	Unit of temperature
CA	Certificate Authority	
CAMP	Crash Avoidance Metrics Partnership	
CCH	Control Channel	See IEEE 1609
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	
dBm	Decibel per Milliwatt	Power ratio in decibels (dB) of the measured power referenced to one milliwatt
DC	Direct Current	
DSRC	Dedicated Short Range Communications	
EDCA	Enhanced Distributed Channel Access	
EEBL	Electronic Emergency Brake Light	
EMI	Electromagnetic Interference	
ESD	Electrostatic Discharge	
F	Fahrenheit	Temperature units
FCC	Federal Communications Commission	
GB	Gigabyte	Unit of storage, consisting of approximately 10 ⁹ 8-bit characters
GHz	Gigahertz	
GPS	Global Positioning System	
HMI	Human Machine Interface	

Abbr.	Description	Definition
Hz	Hertz	
I2V	Infrastructure-to-Vehicle	
IEEE	Institute of Electrical and Electronic Engineers	
IP	Internet Protocol	
IT	Information Technology	
ITS	Intelligent Transportation System	
Km	Kilometer	A unit of length.
LAN	Local Area Network	
LED	Light Emitting Diode	
LMD	Local Management Device	
LRI	Local Roadside Infrastructure	
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	
Mph	Miles per hour	
Ms	millisecond	
MTBF	Mean Time Between Failure	
NEMA	National Electrical Manufacturers Association	
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	
RSE	Roadside Equipment	
RSU	Roadside Unit	
SAE	Society of Automotive Engineers	
SCH	Service Channel	
SD	Secure Digital	
SPaT	Signal Phase and Timing	
SRD	System Requirements Description	Describes requirements for a given system
SVC	Service Channel	See IEEE 1609
TXOP	Transmission Opportunity	See IEEE 802.11-2007
USB	Universal Serial Bus	
UTC	Universal Time, Coordinated	

Abbr.	Description	Definition
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	
WAN	Wide Area Network	
WAVE	Wireless Access in Vehicular Environments	See IEEE 1609
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 a roadside equipment grade electronic module that must be capable of both transmitting and receiving using dedicated short range communications (DSRC) radios, using the 5.9 Gigahertz (GHz) band approved for DSRC use by the Federal Communications Commission (FCC), and implement the appropriate Institute of Electrical and Electronics Engineers (IEEE) and Society of Automotive Engineers (SAE) standards (IEEE 802.11p, IEEE 1609 family, and SAE J2735).

3.2 System Design

The roadside equipment (RSE) device shall have one or more 5.9 GHz DSRC Radio Sets, with each set capable of simultaneously supporting two DSRC radio channels. One channel on each Radio Set shall be used for the transmission of low latency time-critical SAE J2735 safety messages and the second channel in the Radio Set shall be used for transmission of other SAE J2735 messages such as communication for security credentials and security management. The RSE device shall have internal computer processing and permanent storage capability. The RSE will have a set of operational states as illustrated in the following diagram.

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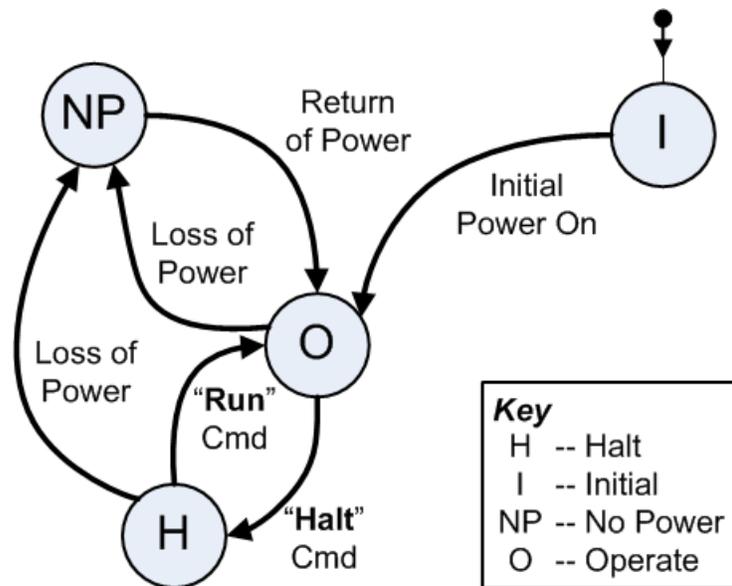


Figure 1.0 Roadside Equipment State Diagram

State	Definition
Halt	<ul style="list-style-type: none"> • DSRC radios cease operations • CML message logging ceases • Configuration changes are enabled
Initial	Nothing. This is the initial power on for the device. This is only a artifact of a logical state table.
No Power	This state results from a loss of power. This is not a graceful shutdown. That would be enacted by a transition to Halt State prior to a transition to the NoPower State,
Operate	<ul style="list-style-type: none"> • All DSRC radios start or resume operations as configured • CML Message logging starts or resumes • Configuration changes are disabled

3.3 System Layout

The diagram below is for reference only. Only the shaded blocks are discussed in this document. Please note that the component labeled “DSRC Radio Set 1” can be deployed as an integral part of the device chassis or it can be deployed in a separate chassis with connectivity back to the device chassis.

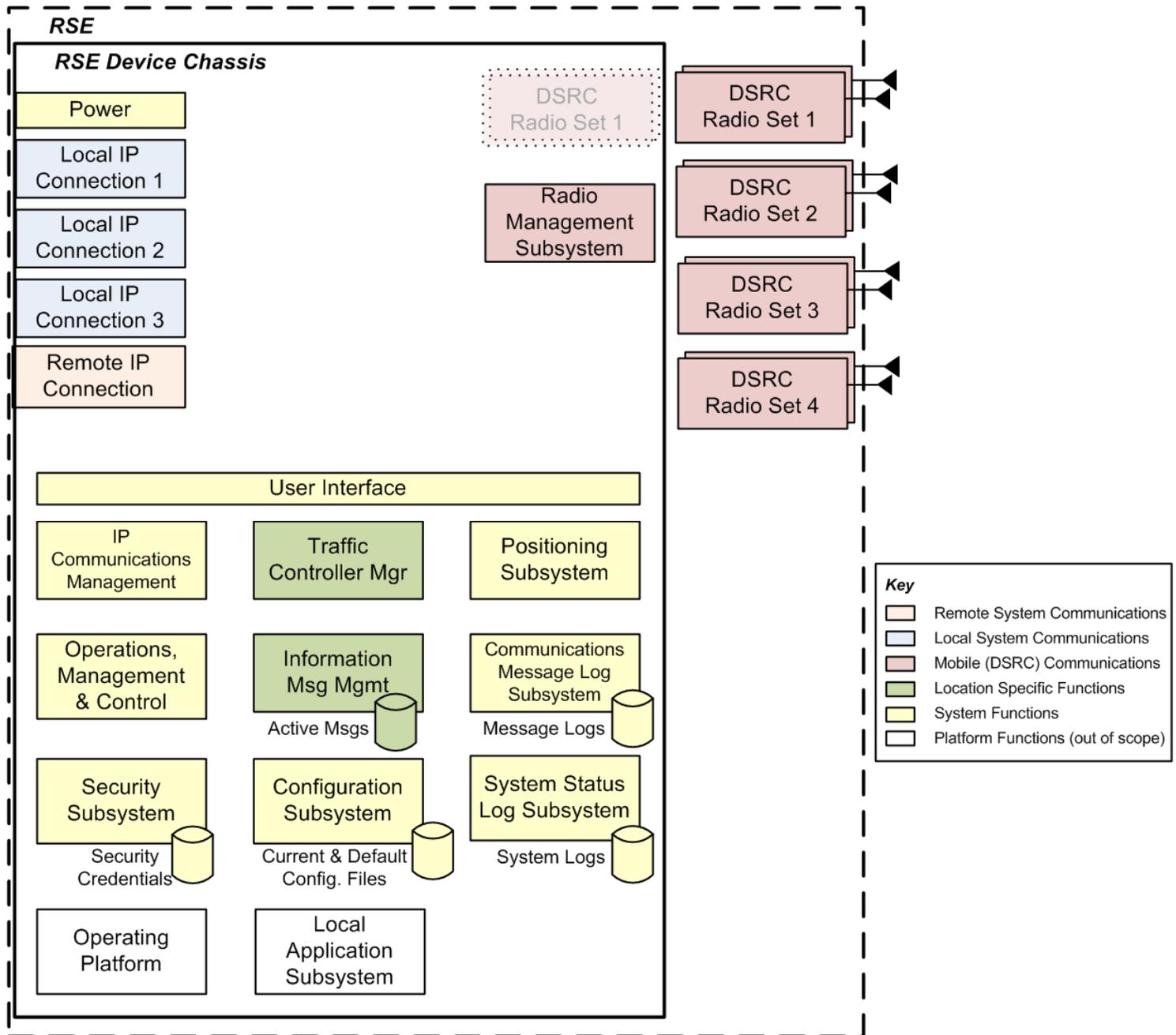


Figure 2.0 – Roadside Equipment Diagram

4 SYSTEM REQUIREMENTS

4.1 Mechanical Requirements

The device shall meet all of the indicated quality requirements listing within this section.

4.1.1 Device Installation

SRD-USDOTRSE-003-ReqSYS001v001 Radio Installation

Description: The roadside equipment device shall have 5.9GHz radios capable of being mounted separately from the main body of the device.

Reference: Section 3.3 Figure 2.0

Purpose: Enables line-of-sight communications.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqSYS002v001 Antenna Installation

Description: The roadside equipment device shall have antennas capable of being mounted separately from the main body of the device.

Reference: None

Purpose: Enables line-of-sight communications.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

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SRD-USDOTRSE-003-ReqSYS003v001 Radio Cabling Type

Description: The roadside equipment device shall have 5.9GHz radios which are mounted separately from the main body of the roadside equipment must support connecting cables of type TBD.

Reference: None

Purpose: Enables connection to main device without attenuation.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqSYS004v001 Radio Cabling Distance

Description: The roadside equipment device shall have 5.9GHz radios which are mounted separately from the main body of the roadside equipment must support connecting cables of a minimum of TBD in length.

Reference: None

Purpose: Enables connection to main device without attenuation.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqSYS005v001 Antenna Cabling

Description: The roadside equipment device shall have antennas mounted separately from the main body of using coaxial cables to connect the radios to the device and shall be not longer than TBD in length.

Reference: None

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Purpose: Enables connection to main device without attenuation.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqSYS006v001 Device Attachment

Description: The roadside equipment device shall have an attachment method (e.g. to a mast arm, on a pad with a traffic signal controller, on a utility pole at the roadside, or on an overhead sign bridge) that allows for ease of installation and removal with common hand tools.

Reference: None

Purpose: Enables ease of installation for operator.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqSYS007v001 Device Status Indicator

Description: The roadside equipment device shall have external LED indicators to indicate the RSE operational state (see Figure 1.0) and for any major errors.

Reference: Section 3.2 Figure 1.0

Purpose: Inform the user the operational status of the device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

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4.2 Performance Requirements

SRD-USDOTRSE-003-ReqSYS008v001 Mean Time Between Failure (MTBF)

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

Reference: None

Purpose: Maximizes device availability time during the safety pilot.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Analysis (Calculation)

4.3 Environmental Requirements

The roadside equipment and all constituent equipment shall be capable 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-USDOTRSE-003-ReqSYS009v001 Operating Voltage

Description: The roadside equipment device shall have a nominal voltage of 48.0 VDC and nominal 110.0 VAC and must be capable of being powered from sources typically found at roadside locations.

Reference: NEMA TS 2-2003 v02.06

Purpose: Ensures power to device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Method: Test

SRD-USDOTRSE-003-ReqSYS024v001 Operating Voltage (remote DSRC Radio Set)

Description: The roadside equipment device shall have a nominal voltage for remote DSRC radios as specified in IEEE 802.3af-2003 or IEEE 802.3at-2009.

Reference: IEEE 802.3af-2003, IEEE 802.3at-2009

Purpose: Ensures power to device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.2 Operating Frequency

SRD-USDOTRSE-003-ReqSYS010v001 Operating Frequency

Description: The roadside equipment device (with the exception of remote DSRC radios) shall have an input voltage operating frequency range of 50 to 60 hertz (Hz).

Reference: NEMA TS 2-2003 v02.06

Purpose: Protect system and sub-system components.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.3 Electrical Emissions

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SRD-USDOTRSE-003-ReqSYS011v001 Electrical Emissions Susceptibility

Description: The roadside equipment device shall be immune to radio frequency (RF)/Electromagnetic Interference (EMI) per SAE J1113 – Electromagnetic Compatibility Measurement Procedure for Vehicle Component.

Purpose: Ensures device will operate without interference from external sources.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.4 Temperature and Humidity

The roadside equipment device shall be designed to withstand long exposure to nearly constant high relative humidity and high temperature defined within this document.

SRD-USDOTRSE-003-ReqSYS012v001 Ambient Temperature

Description: The roadside equipment device shall operate over the temperature range from -34 degrees C (-30 degrees F) to +74 degrees C (+165 degrees F).

Reference: NEMA TS 2-2003 v02.06

Purpose: Ensures device will operate in extreme temperature conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSYS013v001 Ambient Temperature Rate of Change

Description: The roadside equipment device shall operate under changes in ambient temperature up to 17 degrees C (30 degrees F) per hour, throughout the required operational temperature range.

Reference: NEMA TS 2-2003 v02.06

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Purpose: Ensures device will operate in extreme temperature conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSYS014v001 Storage Temperature

Description: The roadside equipment device shall properly operate after storage at a temperature range of -45 degrees C (-50 degrees F) to +85 degrees C (+185 degrees F).

Reference: NEMA TS 2-2003 v02.06

Purpose: Ensures device will operate in extreme temperature conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSYS015v001 Humidity – Average Temperatures

Description: The roadside equipment device shall be capable of continuous operation under a relative humidity of 95% non-condensing over the temperature range of +4.4 degrees C (+40.0 degrees F) to +43.3 degrees C (+110.0 degrees F).

Reference: NEMA TS 2-2003 v02.06

Purpose: Ensures device will operate in extreme moisture conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Verification

Method: Test

SRD-USDOTRSE-003-ReqSYS016v001 Humidity - High Temperatures

Description: The roadside equipment device shall be capable of continuous operation under a relative humidity of 95% non-condensing at temperatures above +43.3 degrees C (+110 degrees F).

Reference: NEMA TS 2-2003 v02.06

Purpose: Ensures device will operate in extreme humidity conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.5 Rain

SRD-USDOTRSE-003-ReqSYS017v001 Rain

Description: The roadside equipment device shall pass the rain test with a rainfall rate of 1.7 mm/min (4in/hour), wind speed of 18 m/sec (40 mph) and 30 minutes on each surface of the device as called out in MIL-STD-810 G method 506.5 Procedure 1.

Reference: MIL-STD-810 G method 506.5 Procedure 1

Purpose: Ensures device will operate in heavy rain conditions without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.6 Salt Fog Protection

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The roadside equipment device shall be designed to withstand salt fog exposure defined within this document.

SRD-USDOTRSE-003-ReqSYS018v001 Salt Fog

Description: The roadside equipment device shall pass the salt fog test with 5% saline exposure for 2 cycles x 48 hours (24 hours wet/24 hours dry) as called out in MIL-STD-810 G method 509.5.

Reference: MIL-STD-810 G method 509.5

Purpose: Ensures system will operate in extreme environmental conditions.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.7 Shock and Vibration

The roadside equipment device shall be designed to withstand shock and vibration defined within this document.

SRD-USDOTRSE-003-ReqSYS019v001 Shock and Vibration Due to Shipping

Description: The roadside equipment device shall withstand shock and vibration from normal shipping and handling as called out in SAE J1211 sections 3.2.7 and 3.2.8.

Reference: SAE J1211 sections 3.2.7 and 3.2.8

Purpose: Ensures device can survive shipping and handling.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

4.3.8 Electrostatic Discharge

The roadside equipment device shall be designed to withstand electrostatic discharge defined within this document.

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SRD-USDOTRSE-003-ReqSYS020v001 Electrostatic Discharge

Description: The roadside equipment device shall be protected from electrostatic discharges as called out in SAE J551.

Reference: SAE J551

Purpose: Ensures device can withstand ESD without failure.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSYS021v001 Removable Storage Electrostatic Discharge

Description: If the roadside equipment is equipped with removable storage, the device's removable storage component(s) shall be protected from electrostatic discharges as called out in SAE J551.

Reference: SAE J551

Purpose: Ensures removable storage can withstand ESD.

Disposition: Mandatory, if device equipped with removable storage

Performance

Criteria: Pass\Fail

Verification

Method: Test

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5 FUNCTIONAL REQUIREMENTS

5.1 Interface Requirements

SRD-USDOTRSE-003-ReqINT001v001 Local IP Interface 1

Description: The roadside equipment device shall provide an Ethernet (port) local systems interface for the exchange of IP data between the roadside equipment and a local system.

Reference: None

Purpose: Enables exchange of data to and from device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqINT002v001 Local IP Interface 2

Description: The roadside equipment device shall provide a (second) local systems interface for the exchange of IP data between the roadside equipment and a local system, using one of the following mechanisms:

Category C

- USB Port (v2.0)
- Ethernet Port (RJ45 Connector)
- Wi-Fi Port

Note: Any combination of Category C interface types may be used for the Local IP Interface 2 and Local IP Interface 3.

Reference: None

Purpose: Enables exchange of data to and from device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Verification

Method: Inspection

SRD-USDOTRSE-003-ReqINT003v001 Local IP Interface 3

Description: The roadside equipment device shall provide a (third) local systems interface for the exchange of IP data between the roadside equipment and a local system, using one of the following mechanisms:

Category C

- USB Port (v2.0)
- Ethernet Port (RJ45 Connector)
- Wi-Fi Port

Note: Any combination of Category C interface types may be used for the Local IP Interface 2 and Local IP Interface 3.

Reference: None

Purpose: Enables exchange of data to and from device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqINT004v001 Remote Systems Interface (RSI)

Description: The roadside equipment device shall provide at least one of the following mechanisms for the exchange of IP data to and from the roadside equipment and a remote system:

Category A

- USB Port (v2.0)
- Ethernet Port (RJ45 Connector)
- Wi-Fi Port
- WiMAX (non-mobile) Port
- Cellular Interface

Category B

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- Removable storage (e.g. SD Card)

Note: Category B Interfaces are only allowed for those (mobile) RSEs that will not require fixed or intermittent backhaul connectivity.

Reference: None

Purpose: Enables exchange of data to and from device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqINT005v001 DSRC Radio Set

Description: The roadside equipment device shall have a 5.9GHz DSRC Radio Set (hereinafter referred to as R1).

Note: A DSRC Radio Set consists of two “paired” DSRC radios intended to be operated simultaneously on different DSRC channels. The R1 DSRC Radio Set may be externally connected to the roadside equipment chassis OR integrated into the roadside equipment chassis, as per Figure 2.0.

Reference: None

Purpose: Application support

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

SRD-USDOTRSE-003-ReqINT006v001 External DSRC Radio Set Interfaces

Description: The roadside equipment device shall have complete physical interfaces for operational support of three (3) external 5.9GHz DSRC Radio Sets (hereinafter referred to as R2, R3 and R4).

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Note: This would allow for up to three (3) external DSRC Radio Sets (in addition to R1) to be connected to the roadside equipment chassis, as per Figure 2.0, for a total of four (4) DSRC Radio Sets. Each additional DSRC Radio Set consists of two “paired” DSRC radios intended to be operated simultaneously on different DSRC channels.

Reference: None

Purpose: Support all necessary connectivity for operational support of three external DSRC Radio Sets.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Inspection

5.2 -003-Operations, Management and Control

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-USDOTRSE-003-ReqOMC001v001 State Transition - Initial to Operate

Description: The roadside equipment device shall perform a state transition from Initial State to Operate State upon power “On” (The first time the device is powered at time of manufacture).

Reference: None

Purpose: State transition handling

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqOMC002v001 State Transition - Operate to Halt

Description: The roadside equipment device shall perform a state transition from Operate State to Halt State in response to an authorized user's "Halt" command.

Reference: None

Purpose: State transition handling

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC003v001 State Transition - Operate to No Power

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

Reference: None

Purpose: State transition handling

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC004v001 State Transition - No Power to Operate

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

Reference: None

Purpose: State transition handling

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC005v001 State Transition - Halt to Operate

Description: The roadside equipment device shall perform a state transition from Halt State to Operate State in response to an authorized user’s “Run” command.

Reference: None

Purpose: State transition handling

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC006v001 State Transition - Halt to No Power

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

Reference: None

Purpose: State transition handling

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.2.2 Operational Modes

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SRD-USDOTRSE-003-ReqOMC007v001 “Connected” Mode

Description: The roadside equipment device shall operate with full functionality while connected (using the RSI) to an operations center.

Note: “Connected Mode” implies that the RSE is intended to be connected via a backhaul circuit to an operations center on a continuous basis.

Reference: None

Purpose: Enables system connectivity in several independent modes.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC008v001 “Reach Back” Mode

Description: The roadside equipment device shall operate with full functionality while intermittently connected to an operations center.

Note: When in “Reachback Mode” the RSE is intended to be connected via a temporary backhaul circuit to an operations center, with the RSE determining when it is necessary, and then initiating the temporary backhaul connection.

Reference: None

Purpose: Enables system connectivity in several independent modes.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqOMC009v001 “Standalone” Mode

Description: The roadside equipment device shall operate with full functionality while not connected to an operations center, until the device’s security credentials expire.

Reference: None

Purpose: Enables system connectivity in several independent modes.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.2.3 Operational Configuration

SRD-USDOTRSE-003-ReqOMC023v001 Software/Firmware

Description: The roadside equipment device shall run or execute the currently installed software/firmware.

Reference: None

Purpose: Enables local system updates .

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC013v001 Configured Operations

Description: The roadside equipment device shall operate based on current operational parameters for itself and its components using configuration information (stored in the Configuration File).

Reference: None

Purpose: Enables reliable information required for maintenance.

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC011v001 Configuration Item Storage

Description: The roadside equipment device shall store operational configuration information related to the status of the device, its components, and other infrastructure elements that may be connected to the device in one or more configuration files (hereinafter referred to as the Configuration File, described in Appendix A).

Reference: None

Purpose: Provides mechanism to change device setup. Please note that configurable parameters will be discussed in the appropriate requirements throughout the document.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC021v001 Configuration Default

Description: The roadside equipment device shall have a default value 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

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Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC014v001 Configuration File Review

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

Reference: None

Purpose: Enables review of the contents of the currently loaded Configuration File.

Disposition: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT001) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT004), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT004).

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC015v001 Configuration Modification

Description: The roadside 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 modification of the contents of the currently loaded Configuration File.

Disposition: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT001) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT004), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT001).

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqOMC024v001 Configuration Modification Validation

Description: The roadside equipment device shall validate each attempted change to the value of any configuration parameter in the Configuration File.

Reference: None

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

Disposition: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT003) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT001), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT001).

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC019v001 Configuration File Off-Load

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

Note: The off-load operation could result in the transfer of the Configuration file directly to a remote back end system or to an intermediate device (e.g., laptop), which would then transfer the logs to the remote system.

Reference: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT001) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT004), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT001).

Purpose: Enables off-loading of the Configuration File from the device for archiving, maintenance or troubleshooting.

Disposition: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT001) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT004), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT001).

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqOMC020v001 Configuration File On-Load

Description: The roadside equipment device shall enable, when the device is in Halt State, an authorized entity to on-load (via the LSI) a Configuration File onto the device.

Reference: None

Purpose: Enables on-loading of Configuration File onto the device for initial configuration, maintenance or troubleshooting.

Disposition: Mandatory for Category C LSI (see SRD-USDOTRSE-003-ReqINT001) and Category A RSI LSI (see SRD-USDOTRSE-003-ReqINT004), Optional for Category B LSI (see SRD-USDOTRSE-003-ReqINT001).

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC027v001 Configuration On-Load Validation

Description: The roadside equipment device shall not accept any (on-loaded) configuration file with an invalid value of any configuration parameter in the Configuration File.

Reference: None

Purpose: Prevents on-loading of an incomplete, faulty or corrupt Configuration File onto the device.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.2.4 System Status Log

SRD-USDOTRSE-003-ReqSSL002v001 System Status Log Storage

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Description: The roadside equipment device shall accept and store messages generated by internal components in formatted files generically called System Status Log (SSL).

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL009v001 System Status Timestamp

Description: The roadside equipment device shall ensure that each logged message contains a UTC timestamp for each logged message.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL010v001 System Status Log Time Threshold

Description: The roadside equipment device shall close the active SSL file when configurable time threshold (default to no time limit) is reached.

Reference: None

Purpose: Enables access to status information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives. The intent is to have the device generate reasonably sized SSL files.

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSSL011v001 System Status Log Size Threshold

Description: The roadside equipment device shall close the active SSL file when configurable size threshold (default to no size limit) is reached.

Reference: None

Purpose: Enables efficient access to status 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-USDOTRSE-003-ReqSSL012v001 System Status Log Close when Halted

Description: The roadside equipment device shall close the active SSL file when transitioning to a Halt state.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL013v001 System Status Log Creation

Description: The roadside equipment device shall create and use a new active SSL file upon closing the previously active SSL file.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL014v001 System Status Log Filename

Description: The roadside equipment device shall create SSL files with unique filenames consisting of a UTC date-stamp and a sequence number.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL015v001 System Status Log Retention

Description: The roadside equipment device shall retain SSL files indefinitely provided that sufficient storage is available.

Reference: None

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Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL016v001 System Status Log Purge

Description: The roadside equipment device shall, if there is insufficient storage available for additional SSL files or records to be generated; purge the oldest of the currently stored SSL files or records until sufficient storage is made available.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL006v001 System Status Log Access

Description: The roadside equipment device shall enable authorized entities to access and review SSL files stored (locally) on the device.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL007v001 System Status Log Off-Load

Description: The roadside equipment device shall enable authorized entities to transfer SSL files from the device to a (remote) back end system.

Note: The off-load operation could result in the transfer of the System Status Log file directly to a remote back end system or to an intermediate device (e.g., laptop), which would then transfer the logs to the remote system.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL017v001 System Status Log Deletion

Description: The roadside equipment device shall enable authorized entities to delete SSL files stored on the device.

Reference: None

Purpose: Enables access to status 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-USDOTRSE-003-ReqSSL018v001 System Status Log Entry Format

Description: All status message log entries shall be stored a format determined by the device maker. The format shall be supplied to USDOT.

Reference: None

Purpose: Determines the format of the message in the SSL.

Disposition: Optional

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSSL019v001 System Status Log Storage Space Minimum

Description: The roadside equipment device shall provide at least 250 MB of storage space for the logging of system status messages in SSL 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

SRD-USDOTRSE-003-ReqSSL019v001 System Status Log Off-Load Initiation

Description: The roadside equipment device shall, on a configurable time interval (default to 24 hours) transmit all closed system status log files to the configured (default to none) destination IP address.

Reference: None

Purpose: Allows .

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.2.5 Device Positioning

SRD-USDOTRSE-003-ReqPOS001v001 Positioning Determination Occurrence

Description: The roadside equipment device shall establish the position of itself (and qualifiers) on the surface of the earth at the configured sample rate (default sample rate 1 Hz).

Reference: None

Purpose: To maintain current equipment position.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqPOS002v001 Positioning Information

Description: The roadside equipment device shall calculate its current reported position using local positioning system.

Reference: None

Purpose: To facilitate operator investigations and troubleshooting.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Method: Test

SRD-USDOTRSE-003-ReqPOS002v001 Positioning Failure Handling

Description: The roadside equipment device shall store a system status log entry should it not be able to determine its current position.

Reference: None

Purpose: To facilitate operator investigations and troubleshooting.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqPOS003v001 Positioning Corrections

Description: The roadside 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.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqPOS004v001 System Timing Source

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

Reference: None

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Purpose: To increase the accuracy of timing information.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqPOS005v001 System Time Standard

Description: The roadside 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

5.2.6 System Management

SRD-USDOTRSE-003-ReqSYS023v001 Software Installation

Description: The roadside equipment device shall support installing and maintaining authorized software additions or modifications components by authorized entities over the LSI.

Reference: None

Purpose: Enables system installation and maintenance updates both remotely and locally.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Method: Test

SRD-USDOTRSE-003-ReqOMC025v001 Heartbeat Transmission

Description: The roadside equipment device shall, when in “Operate” State, transmit a encrypted and signed (Security Profile B.5) IP “heartbeat” message to the configured network address (default to None) of the management entity on a configurable time interval (default to 60 seconds) with the following format.

Field Format	Value								
RSEUnitID=<string>	Configurable text string, provided by Test Conductor								
MessageTimeStamp=<mm/dd/yyyy,hh:mm:ss>	Message generation date and timestamp								
RSEStatusCode=<list>	Comma delimited list of codes <table border="1"> <thead> <tr> <th>Code</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>000</td> <td>Fully Operational</td> </tr> <tr> <td>001</td> <td>CML Automated Off-Load Initiation-Failure</td> </tr> <tr> <td>002</td> <td>CML Storage Threshold 2</td> </tr> </tbody> </table>	Code	Status	000	Fully Operational	001	CML Automated Off-Load Initiation-Failure	002	CML Storage Threshold 2
Code	Status								
000	Fully Operational								
001	CML Automated Off-Load Initiation-Failure								
002	CML Storage Threshold 2								

Reference: A sample of the text string is provided in Appendix E.

Purpose: Support of O&M activities.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC026v001 Heartbeat Transmission Suspension

Description: The roadside equipment device shall suspend transmission of “heartbeat” messages upon detection of an error condition which will significantly impede device operations.

Reference: None

Purpose: Inform the Roadside Equipment operator that there is a significant issue that needs to be addressed.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqOMC028v001 Heartbeat Transmission Suspension Log Message

Description: The roadside equipment device shall generate and attempt to log an SSL message upon the suspension of transmission of “heartbeat” messages.

Reference: None

Purpose: Inform the Roadside Equipment operator that there is a significant issue that needs to be addressed.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.2.7 Communications Message Log

SRD-USDOTRSE-003-ReqCML001v001 Communications Message Storage

Description: The roadside equipment device shall accept and store (log) transmitted and received while in Operate State, communications messages to/from all communications interfaces, as defined in the table below, in formatted files generically called Communications Message Log (CML).

Interface Type	Direction	Traffic Logging Rules
DSRC	Received	All WAVE traffic (802.11p frames) whether intended for the RSE or not.
	Sent	All sent (802.11p frames) traffic
Other	Received	All IP traffic addressed to the RSE. Ignore other LAN/WAN traffic.
	Sent	All sent traffic, except CML files that are

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		offloaded.
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Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML002v001 Communications Message Timestamp

Description: The roadside equipment device shall ensure that each logged communications message contains a UTC timestamp for each logged communications message. (e.g. Transmitted and/or received 802.11p frames).

Note: This requirement can be met through PCAP file timestamp features.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML003v001 Communications Message Separation by Interface

Description: The roadside equipment device shall store messages to/from each communications interface (eg. each DSRC radio, each non-DSRC IP interface) in separate files or a combined file based on configuration parameters (default to Combined) in the Configuration File.

Reference: None

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Purpose: Enables access to communications information required to support system operations, such as diagnosis, troubleshooting and support of wider Safety Pilot objectives. The combined file can be used if the separation by interface can be accomplished post-test.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML004v001 Communications Message Separation by Direction

Description: The roadside equipment device shall store communications messages sent to (outbound) and received from (inbound) each interface in separate files or a combined file based on a configuration parameter (default to Combined) in the Configuration File.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML005v001 Communications Message Log Time Threshold

Description: The roadside equipment device shall close the active CML file when configurable time threshold (default to no time limit) is reached.

Reference: None

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

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML006v001 Communications Message Log Size Threshold

Description: The roadside equipment device shall close the active CML file when configurable size threshold (default to no size limit) is reached.

Reference: None

Purpose: Enables efficient access to communications 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-USDOTRSE-003-ReqCML007v001 Communications Message Log Close when Halted

Description: The roadside equipment device shall close the active CML file when transitioning to a Halt state.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML008v001 Communication Message Log Creation

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Description: The roadside equipment device shall create and use a new active CML file upon closing the previously active CML file.

Note: The new file will not be utilized until the device next enters the Operate State.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML009v001 Communications Message Log Filename

Description: The roadside equipment device shall create CML files with unique filenames consisting of a device name/location, 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-USDOTRSE-003-ReqCML010v001 Communications Message Log Retention

Description: The roadside equipment device shall retain CML files indefinitely provided that sufficient storage is available.

Note: It is anticipated that CML files will be deleted after offloading (See CML014)

Reference: None

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Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML011v001 Communications Message Log Purge

Description: The roadside equipment device shall, if there is insufficient storage available for additional CML files or records to be generated; purge the oldest of the currently stored CML files or records until sufficient storage is made available.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML012v001 Communications Message Log Access

Description: The roadside equipment device shall enable authorized entities to access and review CML files stored (locally) on the device using the Local Interface.

Reference: None

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

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML013v001 Communications Message Log Off-Load

Description: The roadside equipment device shall enable authorized entities to initiate a transfer of CML files from the device to a (remote) back end system using the local interface.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML014v001 Communications Message Log Deletion

Description: The roadside equipment device shall enable authorized entities to delete CML files stored on the device.

Reference: None

Purpose: Enables access to communications 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-USDOTRSE-003-ReqCML016v001 Communications Message Log Format

Description: All transmitted and received 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 communications message in the CML.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML017v001 Communications Message Log Storage Space

Description: The roadside equipment device shall provide at least 4GB of storage space for the logging of transmitted and received 802.11 frames in CML 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

SRD-USDOTRSE-003-ReqCML018v001 CML Automated Off-Load Initiation-Time Threshold

Description: The roadside equipment device shall, on a configurable time interval (default to 1 hour) transmit all closed communications message log files to the configured (default to none) destination IP address (using log file transfer protocol (See Appendix F), security profile B.5 signed but not encrypted (see USDOT SCMS Design Specification)).

Reference: None

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Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML019v001 CML Automated Off-Load Initiation-Size Threshold

Description: The roadside equipment device shall transmit all closed communications message log files to the configured Management Entity over the Remote IP Connection, using the parameters below, when the cumulative size of CML files reaches a configurable threshold (default to 50% of allocated storage space) hereafter referred to as “CML Storage Threshold 1

- Management Entity Address (...default to “None”)
- Retry Count (...default to 3)
- Retry Interval (...default to 300 seconds)

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML023v001 CML Automated Off-Load -Completion

Description: The roadside equipment device shall expunge each off-loaded CML file upon successfully completion of the system initiated off-load operation.

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML024v001 CML Automated Off-Load Initiation-Failure

Description: The roadside equipment device shall include a status code (value 001) in the secure Heartbeat Message upon failure to complete the automatic transfer of closed CML files to the configured Remote Management Entity.

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML020v001 CML Storage Threshold 2 Processing

Description: The roadside equipment device shall include a status code (value 002) in the secure Heartbeat Message to the configured Management Entity over the Remote IP Connection, using the parameters below, when the cumulative size of CML files reaches a configurable threshold (default to 65% of allocated storage space) hereafter referred to as “CML Storage Threshold 2.

- Management Entity Address (...default to “None”)
- Transmission Count (...default to 3)
- Transmission Interval (...default to 15 seconds)

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML021v001 CML Storage Threshold 3 Processing

Description: The roadside equipment device shall halt transmission of secure Heartbeat messages over the Remote IP Connection, when the cumulative size of CML files reaches a configurable threshold (default to 80% of allocated storage space) hereafter referred to as “CML Storage Threshold 3.

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCML022v001 CML File Overwrite

Description: The roadside equipment device shall, when there is insufficient storage to continue logging communications messages, expunge the closed CML file with the oldest modification date.

Reference: None

Purpose: Enables effective management of allocated CML storage space.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.3 DSRC Radio Services

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5.3.1 FCC Compliance

SRD-USDOTRSE-003-ReqDRS001v001 FCC Regulation 47 CFR Compliance for DSRC

Description: The roadside equipment device shall comply with Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, 90, and 95 amendments for Dedicated Short Range Communications (DSRC).

Reference: Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) Parts 0, 1, 2, 90, 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 DSRC Radio Count

SRD-USDOTRSE-003-ReqDRS003v001 Minimum Number of DSRC Radio Sets

Description: The roadside equipment device shall operationally support a minimum of one (1) 5.9GHz DSRC Radio Set (R1).

Reference: None

Purpose: Increased DSRC radio coverage and performance.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqDRS002v001 Maximum Number of DSRC Radio Sets

Description: The roadside equipment device shall operationally support a maximum of four (4) 5.9GHz DSRC Radio Sets (R2, R3 & R4).

Note: On a site basis, up to three external DSRC Radio Sets will be connected to the roadside equipment chassis.

Reference: None

Purpose: Increased DSRC radio coverage and performance.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.3.3 IEEE 802.11

SRD-USDOTRSE-003-ReqDRS005v001 IEEE 802.11 Conformance

Description: The roadside equipment device shall conform to IEEE Std. 802.11-2007, as bounded by the general requirement to fully support the IEEE 802.11p-2010 protocol specification and the IEEE 1609.x protocol specification set.

Reference: IEEE 802.11-2007

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS006v001 IEEE 802.11 Physical Layer

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Description: The roadside 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

SRD-USDOTRSE-003-ReqDRS007v001 IEEE 802.11 Modulation Scheme

Description: The roadside 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: Test

SRD-USDOTRSE-003-ReqDRS008v001 IEEE 802.11 Default Values

Description: The roadside 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

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS009v001 IEEE 802.11 Quality of Service

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

Reference: IEEE 802.11-2007

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS010v001 Arbitration Interframe Spacing Value

Description: The roadside 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.

Note: Vender should provide the limit for X, based on the chip set used

Reference: IEEE 802.11-2007

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqDRS011v001 Transmission Opportunity Value

Description: The 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

SRD-USDOTRSE-003-ReqDRS012v001 Contention Window Minimum Value

Description: The CWmin of a given AC shall take any value of the form $(2^k)-1$, for $k = 1$ through Y .

Note: Vendor should provide the limit for Y , based on the chip set used.

Reference: IEEE 802.11-2007

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.3.4 IEEE 802.11p

SRD-USDOTRSE-003-ReqDRS013v001 IEEE 802.11p Conformance

Description: The roadside 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:

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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-USDOTRSE-003-ReqDRS014v001 IEEE 802.11p Basic Service Set

Description: The roadside equipment device shall send MAC Protocol data units (MPDUs) outside the context of a basic service set (BSS), i.e. with Management Information Base (MIB) variable dot11OCBEnabled is 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-USDOTRSE-003-ReqDRS015v001 IEEE 802.11p Regulatory Class 17

Description: The roadside 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

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Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS016v001 IEEE 802.11p Regulatory Class 18

Description: The roadside equipment device shall support Regulatory class 18 (odd 20 MHz channels in the range 173 to 183).

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-USDOTRSE-003-ReqDRS017v001 IEEE 802.11p Enhanced Distributed Channel Access

Description: The roadside 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

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS018v001 IEEE 802.11p Option Enhanced Receiver Performance

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

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-USDOTRSE-003-ReqDRS019v001 IEEE 1609.2 Conformance

Description: The roadside equipment device shall conform to IEEE P1609.2, Draft 9.3, posted as 1609.2-v2-d9_3-2011-09 for all DSRC radios, as modified by USDOT’s SCMS Design Specification)

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

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Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS062v001 IEEE 1609.2 Security Profile

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

Reference: Appendix B

Purpose: Streamline secure communications processing.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS048v001 IEEE 1609.2 Certificate Storage - Minimum

Description: The roadside equipment device shall store up to five hundred (500) 1609.2 certificates.

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-USDOTRSE-003-ReqDRS049v001 IEEE 1609.2 Certificate Storage - Extended

Description: The roadside equipment device shall be able to simultaneous store at least twenty thousand (20,000) 1609.2 certificates.

Reference: IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9_3-2011-09.

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Purpose: Store sufficient security credentials to support 5 minute life span for at least 60 days (12/hr x 24 hr/day x 60 days).

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS050v001 IEEE 1609.2 Time-Limited Certificates

Description: The roadside equipment device shall support 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.

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTDSE-003-ReqDRS022v001 IEEE 1609.2 Certificate Deletion upon Expiration

Description: The roadside equipment device shall delete expired 1609.2 certificates.

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

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SRD-USDOTRSE-003-ReqDRS051v001 IEEE 1609.2 Certificate Deletion

Description: The roadside equipment device shall enable the deletion of stored 1609.2 certificates by an authorized entity via the LSI when in Halt state.

Reference: None

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS052v001 IEEE 1609.2 Certificate Reload

Description: The roadside equipment device shall enable the re-load of new certificates by an authorized entity via the LSI when in Halt state.

Reference: None

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS020v001 IEEE 1609.2 Certificate Request

Description: The roadside equipment device shall request new 1609.2 certificates, at a configurable set threshold level.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Standards Conformance

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS063v001 IEEE 1609.2 Certificate Threshold

Description: The roadside equipment device shall have a configurable threshold to determine when to request new 1609.2 certificates (default value 50% of the maximum specified in SRD-USDOTRSE-003-ReqDRS049v001).

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDORRSE-003-ReqDRS053v001 IEEE 1609.2 Certificate Request Response Processing

Description: The roadside equipment device shall accept and process responses to 1609.2 certificate requests as defined in IEEE P1609.2.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDORRSE-003-ReqDRS054v001 IEEE 1609.2 Certificate Key Length

Description: The roadside equipment device shall support 256 bit keys sent by the CA as defined in IEEE P1609.2.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDORRSE-003-ReqDRS055v001 IEEE 1609.2 Certificate Revocation List (CRL) Processing

Description: The roadside equipment device shall accept and process 1609.2 CRLs as defined in IEEE P1609.2.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Support for 1609.2 operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS021v001 IEEE 1609.2 Message Signing

Description: The roadside equipment device shall digitally sign each transmitted WSM (including each WSA) using a 1609.2 certificate as defined in IEEE P1609.2, Draft 9.3.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Message Authentication

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS024v001 IEEE 1609.2 Message Certificate or Digest Attachment

Description: The roadside equipment device shall incorporate either a certificate or a certificate digest attached, with each transmitted WSM message, as defined in IEEE P1609.2, Draft 9.3.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Message Authentication

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS026v001 IEEE 1609.2 Certificate Minimum Attachment Interval

Description: The roadside equipment device shall incorporate a 1609.2 digital certificate into a transmitted WSM for every “Nth” transmitted WSM, where “N” is configurable with a default value of 20.

Reference: None

Purpose: Message Authentication

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS027v001 IEEE 1609.2 Certificate Attachment Interval Configuration

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Description: The roadside equipment device shall store the interval for attaching a certificate in the Configuration File.

Reference: None

Purpose: Message Authentication

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDORRSE-003-ReqDRS057v001 IEEE 1609.2 Static Certificate while in an Event Condition

Description: The roadside equipment device shall continue to sign WSMs with the active certificate while a defined event condition exists.

Reference: SAE J2735 2009-11

Purpose: Maintain Device identity while in an Event Condition

Disposition: Optional

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS058v001 Randomize MAC Addresses on Certificate Change

Description: The roadside equipment device shall randomize all DSRC radio MAC Addresses upon a change of IEEE 1609.2 Certificate.

Note: A comprehensive MAC addressing policy will be defined in an upcoming version of CAMP VSC3 MPR Specification.

Reference: IEEE P1609.2, Draft 9.3, posted to IEEE website as 1609.2-v2-d9_3-2011-09.

Purpose: Device Anonymity

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS059v001 Inbound Message Acceptance

Description: The roadside equipment device shall accept all incoming WAVE messages (whether signed or not signed).

Note: Any validly formed message must be logged, irrespective of the system's decision to authenticate or not.

Reference: None

Purpose: Streamline secure communications processing.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS023v001 IEEE 1609.2 Message Authentication

Description: Upon request from an (typically co-located) application, the roadside equipment device shall allow authentication of received digitally signed messages from a DSRC communications interface.

Note: Any validly formed message must be logged, irrespective of the system or any applications' decision to authenticate or not. If the system, or an application, chooses to authenticate a message, then it must reject a message that fails authentication.

Reference: None

Purpose: Support for 1609.2 operations in potential but not yet defined applications in Safety Pilot/Model Deployment.

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS060v001 Unauthenticated Message Rejection

Description: The roadside equipment device shall reject (expunge) all messages from unidentified or uncertified sources, as controlled by the application.

Note: Any validly formed message must be logged, irrespective of the system's, or any applications', decision to authenticate or not. If the system, or an application chooses to authenticate a message, then it must reject a message that fails authentication. Rejected messages should be expunged.

Reference: None

Purpose: Enables data integrity and security.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS061v001 IEEE 1609.2 Protocol Use for Non-DSRC IP Data Exchange (Under Development)

Description: The roadside equipment device shall support the exchange of 1609.2 signed and encrypted data over non-DSRC IP communications interfaces (Remote IP and Local IP Connections).

Note: IP based communications will be used for the exchange of 1609.2 signed and encrypted data between the roadside equipment and the 1609.2 security credential management system.

Reference: IEEE P1609.2 Draft 9.3, IEEE 1609.3-2010

Purpose: Secure exchange of security credentials with SCMS.

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

5.3.6 IEEE 1609.3

SRD-USDOTRSE-003-ReqDRS028v001 IEEE 1609.3 Conformance

Description: The roadside equipment device shall conform to IEEE 1609.3-2010 for all radios.

Reference: IEEE 1609.3-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS044v001 IEEE 1609.3 IP Data

Description: The roadside equipment device shall process both transmitted and received IPv6 packets.

Note: At a minimum, IP based communications over DSRC will be used for the exchange of data between the onboard equipment and the 1609.2 security credential management system.

Reference: IEEE 1609.3-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS045v001 IEEE 1609.3 WSMP Data

Description: The roadside equipment device shall process (both transmit and receive) WAVE Short Message Protocol (WSMP) messages.

Reference: IEEE 1609.3-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS029v001 IEEE 1609.3 PSID-Specific User Priority

Description: The roadside equipment device shall assign a configurable PSID value (default to the value specified for the associated application area defined in IEEE 1609.12, D0.5) and a configurable User Priority value (default to 2) to each data frame.

Reference: IEEE 1609.3-2010, IEEE P1609.12/D0.5

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS030v001 IEEE 1609.3 WSMP Header Options

Description: The roadside equipment device shall support the configurable setting of the following WSMP header options, as part of the configuration file:

- Data Rate

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- Transmit Power Used

Reference: IEEE 1609.3-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS031v001 IEEE 1609.3 WSM Congestion Controlled Transmission Rate

Description: The roadside equipment device shall transmit WAVE messages as per the TBD congestion control algorithm.

Note: The CAMP VSC3 – Congestion Control Document (which will be made available upon request) is expected in Spring, 2012

Reference: IEEE 1609.3-2010

Purpose: Standards Conformance

Disposition: Optional

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.3.7 IEEE 1609.4

SRD-USDOTRSE-003-ReqDRS032v001 IEEE 1609.4 Standard Conformance

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

Reference: IEEE 1609.4-2010

Purpose: Standards Conformance

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS033v001 IEEE 1609.4 Radio Operating Mode Support

Description: Each DSRC radio in the roadside equipment device shall be capable of being configured to operate either in "continuous" (single channel) or "alternating" (Channel Switching) modes, as shown in IEEE 1609.4-2010 (Figure 10).

Reference: IEEE 1609.4-2010

Purpose: Turn Channel Switch mode on and off

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS037v001 IEEE 1609.4 Radio Channel Usage

Description: Each DSRC radio in the roadside 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 channels with no time interval restrictions.

Reference: IEEE 1609.4-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqDRS046v001 IEEE 1609.4 Continuous Channel Mode

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

Reference: IEEE 1609.4-2010

Purpose: DSRC Radio Operations.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS047v001 IEEE 1609.4 Alternating Channel Mode

Description: If configured for “alternating” mode, a DSRC radio in the roadside 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.

Reference: IEEE 1609.4-2010

Purpose: DSRC Radio Operations

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS041v001 Service Channel Interval

Description: If configured for “alternating” mode, a DSRC radio in the roadside equipment device shall be configurable to switch on every SCH interval to the configured SCH with no time interval restrictions.

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Reference: IEEE 1609.4-2010

Purpose: DSRC Radio Operations

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS038v001 DSRC Alternating Channel Mode - Service Channel Selection

Description: The roadside equipment device shall operate all DSRC radios configured for Alternating Channel mode with the same (configurable) service channel.

Reference: None

Purpose: Support for other messages.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS034v001 DSRC Radio Set Operations

Description: The roadside equipment device shall operate each constituent DSRC Radio Set (R1, and if present, R2, R3 and R4) with the respective radios within each set/pair exclusively configured to support one of the following modes, as defined in IEEE 1609.4:

- Continuous Channel Mode (operating **continuously** on a single Service Channel)
- Alternating Channel Mode (**switched** between the Control Channel and a Service Channel)

Note: Within each Radio Set, the radio channels will hereinafter be referred to as follows:

Radio Set Identifier	Radio Channel Identifier	Channel Mode
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Radio Set Identifier	Radio Channel Identifier	Channel Mode
R1	R1A	Alternating
	R1C	Continuous
R2	R2A	Alternating
	R2C	Continuous
R3	R3A	Alternating
	R3C	Continuous
R4	R4A	Alternating
	R4C	Continuous

Reference: IEEE 1609.4-2010

Purpose: Support Safety Pilot objectives.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS035v001 DSRC Radios – Default Single Channel Mode

Description: The roadside equipment device shall operate R1C and if present, R2C, R3C and R4C, in Continuous Channel Mode with a default channel setting of 172.

Reference: IEEE 1609.4

Purpose: Support for low latency safety messages.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS036v001 DSRC Radios – Default Alternating Channel Mode

Description: The roadside equipment device shall operate R1A and if present, R2A, R3A and R4A in Alternating Channel Mode (default Control Channel – 178, default Service Channel – 174).

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Reference: None

Purpose: Support for other messages.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS039v001 IEEE 1609.4 Avoid Synchronized Collision

Description: In a Channel switching configuration, when the roadside equipment is configured to transmit messages on Ch. 178 during the CCH interval, the device shall avoid the synchronized collision phenomenon discussed in Annex B of IEEE 1609.4-2010.

Reference: IEEE 1609.4-2010

Purpose: Standards Conformance

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS040v001 IEEE 1609.4 Readdressing Option

Description: The roadside 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

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Verification
Method: Test

5.3.8 Radio Performance

SRD-USDOTRSE-003-ReqDRS042v001 DSRC Radio Receive Range

Description: The roadside equipment device shall receive DSRC communication signals 360 degrees around the device 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

SRD-USDOTRSE-003-ReqDRS043v001 DSRC Radio Transmission Range

Description: The roadside equipment device shall transmit DSRC communication signals 360 degrees around the a device 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 Wave Service Advertisements (WSA)
- With a WSA Transmission Rate of 10 Hz
- 6 Mbps data rate

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Note: The WSA, while not intended to be transmitted over channels other than 178, will be used to facilitate testing.

Reference: None

Purpose: Enables common test procedures

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqDRS044v001 DSRC Radio Transmission Range Limit

Description: The roadside equipment’s DSRC radio transmissions shall not be detectable outside of a radius of 1 kilometer (km) from any of the roadside equipment’s DSRC radio antennas.

Reference: None

Purpose: Enables common test procedures.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.4 Other Communications

SRD-USDOTRSE-003-ReqCOM001v001 Local IP Interface 1 – Protocol Support

Description: The roadside equipment device shall employ one of the following protocol suites for the (Ethernet) Local IP Interface 1 defined in SRD-USDOTRSE-003-ReqINT001v002.

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

Reference: None

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Purpose: Supports local access for configuration, maintenance and data exchange over non-DSRC communications interface.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCOM002v001 Local Systems Interface 2 – Protocol Support

Description: The roadside equipment device shall employ one of the following protocol suites for the Category C interface type implemented for Local IP Interface 1, defined in SRD-USDOTRSE-003-ReqINT002v001.

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

Reference: None

Purpose: Supports local access for configuration, maintenance and data exchange over non-DSRC communications interface.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCOM003v001 Local Systems Interface 3 – Protocol Support

Description: The roadside equipment device shall employ one of the following protocol suites for the Category C interface type implemented for Local IP Interface 3, defined in SRD-USDOTRSE-003-ReqINT003v001.

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

Reference: None

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Purpose: Supports local access for configuration, maintenance and data exchange over non-DSRC communications interface.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqCOM004v001 Remote Systems Interface – Protocol Support

Description: The roadside equipment device shall employ one of the following protocol suites for the Category A interface type implemented for Remote IP Interface, defined in SRD-USDOTRSE-003-ReqINT004v001.

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

Reference: None

Purpose: Supports remote access for configuration, maintenance and data exchange over non-DSRC communications interface.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSEC001v001 IP Communications Interface Access Control

Description: The roadside equipment device shall maintain access control (e.g. configurable firewalls and ACLs) for each non-DSRC communications interface configured for IP using the rules specified in Appendix C.

Reference: None

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

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSEC014v001 Secure Non-DSRC IP Communications

Description: The roadside equipment device shall support at least one of the following secure access mechanisms for each non-DSRC communications interface (LS1, LS2, LS3 and RSI) 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-USDOTRSE-003-ReqSEC015v001 Secure Non-DSRC IP Communications Account Password Reset

Description: All roadside equipment system accounts for the RSE or any non-DSRC communications interfaces shall have resettable passwords.

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

Reference: None

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

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSEC016v001 Failed Non-DSRC IP Communications Access Attempt Reporting

Description: The roadside equipment device shall log a system status log message for each failed access attempt to any non-DSRC communications interface which is configured for IP.

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 Location Specific Functions

This section identifies functional requirements for roadside equipment functions (or features) that will be enabled on a configurable basis. Typically these functions will be enabled based on the roadside location and the associated roadside infrastructure at that location at which the device is deployed. Additional features and associated requirements may be added in future versions of this specification.

SRD-USDOTRSE-003-ReqMSG001v001 Handling Duplicate Received WAVE Messages

Description: The roadside equipment device shall filter out on a configurable basis (default to ON) duplicate received WAVE messages (due to multiple radios) before forwarding to the destination (this would include the CML).

Reference: None

Purpose: Supports configurable de-duplication of received WAVE messages.

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqMSG002v001 Logging Duplicate Received WAVE Messages

Description: The roadside equipment device shall be able to filter out duplicate received WAVE messages (due to multiple radios) before or after the logging of each duplicate message into the active CML file, on a configurable basis (default to AFTER)

Reference: None

Purpose: Supports configurable logging of duplicate received WAVE messages

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqMSG003v001 WAVE Message Transmission

Description: The roadside equipment device shall transmit an outbound WAVE message to each active DSRC radio which is configured to support the targeted transmit channel of the message.

Note: For example, a WAVE configured for transmission over the control channel will be sent to each radio configured for “Alternating Mode”.

Reference: None

Purpose: Enables interoperability by using industry standard message definitions.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Verification

Method: Test

SRD-USDOTRSE-003-ReqMSG004v001 Message Scheduling

Description: The roadside equipment device shall, whether in networked or “stand alone” mode, schedule the transmission of messages according to a configurable common time and date schedule.

Reference: SAE J2735 2009-11

Purpose: Enables time correlation of messages.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.5.1 Message Processing – Immediate Forwarding

This sub-section describes the handling of “pass through” communications messages; in effect those which do not terminate at the Roadside Equipment device, nor are intended to be stored for subsequent replay. These messages will be routed from the received interface to the appropriate destination interface.

5.5.1.1 IP Traffic

SRD-USDOTRSE-003-ReqIPM001v001 IP Message Routing

Description: The roadside equipment device shall forward all IP messages (which were received over communications interfaces in accordance with the rules specified in Appendix C) over the appropriate interface, based on the destination address of the IP message.

Reference: None

Purpose: Enables pass through processing of messages classified for immediate forwarding.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Method: Test

SRD-USDOTRSE-003-ReqIPM002v001 IP Message Processing

Description: The roadside equipment device shall forward all accepted (received over communications interfaces in accordance with the rules specified in Appendix C) IP messages on a “First In – First Out (FIFO) basis in the absence of a configured QOS policy.

Reference: None

Purpose: Enables pass through processing of messages classified for immediate forwarding.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

5.5.1.2 Traffic Controller Messages

Messages received from a connected Traffic Signal Controller should be sent directly to the DSRC radios for transmission, and will not be buffered for replay.

SRD-USDOTRSE-003-ReqTCM002v001 Traffic Controller Interface – Receive Message

Description: The roadside equipment device shall accept any message received from a connected traffic controller (without authentication).

Note: RSE devices may be connected to a traffic controller system over LS1, LS2 or LS3.

Reference: None

Purpose: Enables SPaT/GID message communication.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

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Verification
Method: Test

SRD-USDOTRSE-003-ReqTCM003v001 Traffic Controller Message – Transmit over DSRC

Description: The roadside equipment device shall transmit each message received from a traffic controller over its DSRC radios according to the configured DSRC parameters (bypassing the Active Message List).

Reference: None

Purpose: Enables SPaT/GID message communication.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification
Method: Test

SRD-USDOTRSE-003-ReqTCM004v001 Traffic Controller Connection State

Description: The roadside equipment device shall log a system status log entry identifying and time-stamping a loss in connectivity to the traffic controller as defined by a configurable threshold.

Reference: None

Purpose: Support testing and troubleshooting activities.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification
Method: Test

5.5.2 Message Processing – Store and Replay

The roadside equipment device shall accept and authenticate roadway geometry (map) and other information messages (arriving over non-DSRC communications links), storing them locally for subsequent broadcasting according to associated delivery instructions over DSRC links. These messages are intended for mobile

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applications and include, for example, speed limit notifications, scheduled school crossing notifications (when vehicles enter school crossing points and school zones). These general message processing requirements apply to any or all of the location specific features described in subsequent subsections.

SRD-USDOTRSE-003-ReqSAR001v001 Information Message Storage

Description: The roadside equipment device shall store up to a configurable number (default of 15, maximum of 100) of SAE J2735 defined messages (hereinafter referred to as an Active Message) along with each message’s associated DSRC broadcast parameters (see bullet list below, hereinafter referred to as Message Distribution Instructions) in a cohesive structured list (hereinafter referred to as the Active Message List).

- Message Type/Description (e.g. TIM)
- Message PSID and Priority (as set by Test Conductor)
- Transmission Channel (172, CCH, SCH ...as set by Test Conductor)
- Transmission Broadcast Interval ...0.05 to 20.0 seconds)
- Message Delivery (broadcast) start time
- Message Delivery (broadcast) stop time

Reference: None

Purpose: Enables device to store messages for subsequent broadcast according to user supplied instructions.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR002v001 Active Message List On-Load

Description: The roadside equipment device shall allow, when in Halt state, an authorized entity to download (to the roadside equipment over a non-DSRC communication interface) a correctly-structured Active Message List replacing the current Active Message List.

Reference: None

Purpose: Enables device to store messages for subsequent broadcast according to user supplied instructions.

Disposition: Mandatory

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Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR003v001 Active Message List Off-load

Description: The roadside equipment device shall allow, when in Halt state, an authorized entity to offload the current Active Message List from the roadside equipment over a non-DSRC communication interface to an external system.

Reference: None

Purpose: Enables device to upload Active Message List for support of test activities or O&M activities.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR004v001 Active Message List Review

Description: Upon request, the roadside equipment device shall allow, when in Halt state, an authorized entity to review the contents (e.g. message id, message type, message distribution instructions) of the Active Message List.

Reference: None

Purpose: Enables device to review the Active Message List for support of test activities or O&M activities.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqSAR005v001 Active Message Addition

Description: The roadside equipment device shall allow, when in Halt state, an authorized entity to add an Active Message into the Active Message List, provided the Active Message List has an “empty” slot.

Reference: None

Purpose: Enables device to enter new information messages into the Active Message List.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR006v001 Active Message Modification

Description: The roadside equipment device shall allow, when in Halt state, an authorized entity to modify an Active Message stored in the Active Message List.

Reference: None

Purpose: Enables device to delete information messages from the Active Message List.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR007v001 Active Message Deletion

Description: The roadside equipment device shall allow, when in Halt state, an authorized entity to delete an Active Message from the Active Message List.

Reference: None

Purpose: Enables device to delete information messages from the Active Message List.

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Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR008v001 Active Message List - User Operation Logging

Description: The roadside equipment device shall log a system status log message for each authorized user operation (e.g. upload, download, addition, modification or deletion) attempted on the Active Message List.

Reference: None

Purpose: Enables device to log any change to the message list

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR009v001 Active Message Transmission

Description: The roadside equipment device shall transmit each Active Message in the Active Message List according to the associated Message Distribution Instructions.

Reference: None

Purpose: Enables device to transmit information messages based on DSRC transmission parameters associated with the SAE J2735 message type.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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SRD-USDOTRSE-003-ReqSAR010v001 Active Message Expunge

Description: The roadside equipment device shall remove an Active Message from the Active Message List according to its respective MessageDeliveryStop field value in the associated Message Distribution Instructions.

Reference: None

Purpose: Enables Active Message List to expunge expired Active Messages.

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR015v001 Active Message List – Operation Logging

Description: The roadside equipment device shall log a System Status Log Message containing the results (success, qualified failure) of each system initiated operation (e.g. start transmission, stop transmission, expunge), attempted on the Active Message List.

Reference: None

Purpose: Enables device to log any change to the active message list

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

SRD-USDOTRSE-003-ReqSAR016v001 Active Message List – Operation Failure Logging

Description: The roadside equipment device shall log a System Status Log Message for a failure in operation (e.g. start transmission, stop transmission, expunge) attempted to the Active Message List.

Reference: None

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Purpose: Enables device to log any change to the active message list

Disposition: Mandatory

Performance

Criteria: Pass\Fail

Verification

Method: Test

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Appendix A: Configuration File Format

(Under Development)

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

A configuration file format will not be needed for the Safety Pilot/Model Deployment installation but should be anticipated at some time in the future.

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Appendix B: Security Profile

The Security Profile has been moved to the forthcoming revised version of the USDOT Security Credential Management System Design, tentatively scheduled for release in February 29, 2012,

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Appendix C: Firewall Rules

Table C.1 – RSE Protected Interfaces

Interfaces	Purpose
<ul style="list-style-type: none"> • DSRC Radio Set 1 – DSRC Interface • DSRC Radio Set 2 – DSRC Interface • DSRC Radio Set 3 – DSRC Interface • DSRC Radio Set 4 – DSRC Interface 	Wireless communications with other DSRC enabled mobile devices and with DSRC enabled infrastructure devices.
<ul style="list-style-type: none"> • External DSRC Radio Set 1 to RSE • External DSRC Radio Set 2 to RSE • External DSRC Radio Set 3 to RSE • External DSRC Radio Set 4 to RSE 	Connect external DSRC radio sets to RSE Chassis
<ul style="list-style-type: none"> • RSE Interface to External DSRC Radio Set 1 • RSE Interface to External DSRC Radio Set 2 • RSE Interface to External DSRC Radio Set 3 • RSE Interface to External DSRC Radio Set 4 	Connect RSE Chassis to external DSRC radio sets
<ul style="list-style-type: none"> • Local IP Connection 1 • Local IP Connection 2 • Local IP Connection 3 	Connect to Local Roadside Infrastructure (LRI, e.g. traffic signal controller) or to a Local Management Device (LMD, laptop) for configuration and management of the RSE.
<ul style="list-style-type: none"> • Remote IP Connection 	Connection to security certificate authority and to remote management center.

Table C.2 – Method of Assigning IP Addresses to Protected RSE Interfaces

Interfaces	Addressing Scope	
<ul style="list-style-type: none"> • DSRC Radio Set 1 – DSRC Interface • DSRC Radio Set 2 – DSRC Interface • DSRC Radio Set 3 – DSRC Interface • DSRC Radio Set 4 – DSRC Interface 	IPv6	Assigned IPV6 global, routable
	IPv4	N/A
<ul style="list-style-type: none"> • External DSRC Radio Set 1 to RSE • External DSRC Radio Set 2 to RSE • External DSRC Radio Set 3 to RSE • External DSRC Radio Set 2 to RSE 	IPv6	TBD
	IPv4	TBD
<ul style="list-style-type: none"> • RSE Interface to External DSRC Radio Set 1 • RSE Interface to External DSRC Radio Set 2 • RSE Interface to External DSRC Radio Set 3 • RSE Interface to External DSRC Radio Set 4 	IPv6	TBD
	IPv4	TBD
<ul style="list-style-type: none"> • Local IP Connection 1 • Local IP Connection 2 • Local IP Connection 3 	IPv6	Link-local, non-routable
	IPv4	Assigned, non-routable
<ul style="list-style-type: none"> • Remote IP Connection 	IPv6	Assigned, Routable
	IPv4	Assigned, Routable



Table C.3 – IP Interface Security Configuration

Interface				Firewall Policies
<ul style="list-style-type: none"> • DSRC Radio Set 1 – DSRC Interface • DSRC Radio Set 2 – DSRC Interface • DSRC Radio Set 3 – DSRC Interface • DSRC Radio Set 4 – DSRC Interface 	Allow	IPv6	Ingress	Safety Pilot OBE to Safety Pilot Security System
			Egress	Safety Pilot Security System to Safety Pilot OBEs ...ONLY after initial connection initiated by OBE
		IPv4	Ingress	N/A
			Egress	N/A
	Deny	IPv6	Ingress	All except those defined in the “Allow” section
			Egress	All except those defined in the “Allow” section
		IPv4	Ingress	N/A
			Egress	N/A
<ul style="list-style-type: none"> • External DSRC Radio Set 1 to RSE • External DSRC Radio Set 2 to RSE • External DSRC Radio Set 3 to RSE • External DSRC Radio Set 2 to RSE 	Allow	IPv6	Ingress	TBD
			Egress	TBD
		IPv4	Ingress	TBD
			Egress	TBD
	Deny	IPv6	Ingress	TBD
			Egress	TBD
		IPv4	Ingress	TBD
			Egress	TBD
<ul style="list-style-type: none"> • RSE Interface to External DSRC Radio Set 1 • RSE Interface to External DSRC Radio Set 2 • RSE Interface to External DSRC Radio Set 3 • RSE Interface to External DSRC Radio Set 4 	Allow	IPv6	Ingress	TBD
			Egress	TBD
		IPv4	Ingress	TBD
			Egress	TBD
	Deny	IPv6	Ingress	TBD
			Egress	TBD
		IPv4	Ingress	TBD
			Egress	TBD

Interface				Firewall Policies
<ul style="list-style-type: none"> Local IP Connection 1 Local IP Connection 2 Local IP Connection 3 	Allow	IPv6	Ingress	<ul style="list-style-type: none"> Traffic (1609.2 Encrypted & Signed) from LMD to RSE (TCP/IP Port – TBD) Traffic from LRI to RSE (TCP/IP Port – TBD)
			Egress	<ul style="list-style-type: none"> Traffic (1609.2 Encrypted & Signed) from RSE to LMD (TCP/IP Port – TBD) Traffic from RSE to LRI (TCP/IP Port – TBD)
		IPv4	Ingress	<ul style="list-style-type: none"> Traffic from LRI to RSE (TCP/IP Port – TBD)
			Egress	<ul style="list-style-type: none"> Traffic from RSE to LRI (TCP/IP Port – TBD)
	Deny	IPv6	Ingress	<ul style="list-style-type: none"> All other sources except those listed in the “Allow” section.
			Egress	<ul style="list-style-type: none"> All other destinations except those listed in the “Allow” section.
		IPv4	Ingress	<ul style="list-style-type: none"> All other sources except those listed in the “Allow” section.
			Egress	<ul style="list-style-type: none"> All other destinations except those listed in the “Allow” section.
<ul style="list-style-type: none"> Remote IP Connection 	Allow	IPv6	Ingress	<ul style="list-style-type: none"> Traffic (1609.2 Encrypted & Signed) from RME to RSE ...ONLY after initial connection initiated by RSE Traffic (TCP/IP Port – TBD)
			Egress	<ul style="list-style-type: none"> Traffic (1609.2 Encrypted & Signed) from RSE to RME (UDP or TCP/IP Port – TBD)
		IPv4	Ingress	<ul style="list-style-type: none"> None
			Egress	<ul style="list-style-type: none"> None
	Deny	IPv6	Ingress	<ul style="list-style-type: none"> All other sources except those listed in the “Allow” section.
			Egress	<ul style="list-style-type: none"> All other destinations except those listed in the “Allow” section.
		IPv4	Ingress	<ul style="list-style-type: none"> All other sources except those listed in the “Allow” section.
			Egress	<ul style="list-style-type: none"> All other destinations except those listed in the “Allow” section.



Appendix D: Immediate Forward/Store and Replay Message File Format

The following is an example of a text file that could be loaded on to the RSE per manufacture instruction after the RSE has been placed in the Halt state, or presented to an RSE’s Local Interface as a UDP packet. If loaded during the Halt state, the RSE would discover the file when it next transitions into the Operate state. The Safety Pilot/Model Deployment Test Conductor will provide the specific files related to the specific installations that will be used during operational activities.

General Format, with comments

```
# Message File Format
# Modified Date: 02/17/2012
# Version: 0.5
Version=0.5
#
# Message Dispatch Items
#
# All line beginning with # shall be removed in file sent to radio
#
# Message Type
# Model Deployment allowed values: SPAT, MAP, TIM
Type=SPAT
#
# Message PSID
PSID=0xBFEE0
#
# Message Priority in the range of 0 (lowest) through 7
Priority=7
#
# Transmission Channel Mode
# Model Deployment allowed values: CONT, ALT
TxMode=CONT
# Model Deployment allowed values: 172, CCH, SC H
TxChannel=172
#
# Transmission Broadcast Interval in Seconds
# Model Deployment allowed values: 0 for Immediate-Forwarding , 1 to 5 for # Store-and-Reply
TxInterval=0
#
# Message Delivery (broadcast) start time (UTC date and time) in the form: "mm/dd/yyyy, hh:mm"
# Leave value blank if Immediate Forward mode
DeliveryStart=
#
# Message Delivery (broadcast) stop time (UTC date and time) in the form: "mm/dd/yyyy, hh:mm"
# Leave value blank if Immediate Forward mode
DeliveryStop=
#
# Message Signature/Encryption
```

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```

Signature=True
Encryption=False
#
# Message Payload (encoded according to definition)
Payload=070000A301010E0204000000640308E8C7F0A02E00A2CA04010108020140050201010602002E091602F7
B024F1604EEB5077E2A0BCD9A10ED25173CB01EA050202010602004E090A03034094140068100000050203010602
006E09130208DFDC0E2FC816EFC628F4D632BFDF221FCE050204010602002A091602FF7FA5FC7F53F8BEECF65E97
F82E34FDBDFF044DE30502050106020024090D02FE0FB3FCBF8EFB4F65FA1F3EFF7394

```

SPaT message example, without comments

```

Version=0.5
Type=SPAT
PSID=0xBFEE0
Priority=7
TxMode=CONT
TxChannel=172
TxInterval=0
DeliveryStart=
DeliveryStop=
Signature=True
Encryption=False
Payload=070000A301010E0204000000640308E8C7F0A02E00A2CA0401010802010050201010602002E091602F7B
024F1604EEB5077E2A0BCD9A10ED25173CB01EA05020201602004E090A0303409414006810000005020301060200
6E09130208DFDC0E2FC816EFC6284D632BFDF221FCE050204010602002A091602FF7FA5FC7F53F8BEECF65E97F82
E34FDBDFF44DE30502050106020024090D02FE0FB3FCBF8EFB4F65FA1F3EFF7394

```

MAP message example, with comments

```

# Message File Format
# Modified Date: 02/17/2012
# Version: 0.5
Version=0.5
#
# Message Dispatch Items
#
# All line beginning with # shall be removed in file sent to radio
#
# Message Type
# Model Deployment allowed values: SPAT, MAP, TIM
Type=MAP
#
# Message PSID
PSID=0xBFF0
#
# Message Priority in the range of 0 (lowest) through 7
Priority=7
#
# Transmission Channel Mode
# Model Deployment allowed values: CONT, ALT
TxMode=CONT
# Model Deployment allowed values: 172, CCH, SCH
TxChannel=172
#

```

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```

# Transmission Broadcast Interval in Seconds
# Model Deployment allowed values: 0 for Immediate-Forwarding , 1 to 5 for
#   Store-and-Reply
TxInterval=0
#
# Message Delivery (broadcast) start time (UTC date & time) in the form: "mm/dd/yyyy, hh:mm"
# Leave value blank if Immediate-Forwarding mode
DeliveryStart=
#
# Message Delivery (broadcast) stop time (UTC date & time) in the form: "mm/dd/yyyy, hh:mm"
# Leave value blank if Immediate-Forwarding mode
DeliveryStop=
#
# Message Signature/Encryption
Signature=True
Encryption=False
#
# Message Payload (encoded according to definition)
Payload=870000A301010E0204000000640308E8C7F0A02E00A2CA04010108020140050201010602002E091602F7B
024F1604EEB5077E2A0BCD9A10ED25173CB01EA050202010602004E090A0303409414006810000005020301060200
6E09130208DFDC0E2FC816EFC628F4D632BFDF221FCE050204010602002A091602FF7FA5FC7F53F8BEECF65E97F82
E34FDBDFF044DE30502050106020024090D02FE0FB3FCBF8EFB4F65FA1F3EFF7394

```

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Appendix E: Heartbeat Transmission Text String Format

The following text string will be transmitted according to configuration settings.

```
# Message File Format
# Modified Date: 10/31/2011
# Version: 0.1
#
# Format Convention:
# Comments are followed by either '#' or ';' and should not be
# considered as part of the message items.
# Empty lines should be ignored.
#
#
# Message Dispatch Items
#
# Message Type (e.g. RSE Heartbeat Message)
MessageType=RSE_Heartbeat_Message
#
# Message Priority (as set by Test Conductor) in the range of 0 through 7 with 0 being the
lowest priority
MessagePriority=2
#
# Transmission Mode (TCP or UDP as set by Test Conductor)
TransmissionTransportLayerProtocol=UDP
TransmissionDestinationIPAddress=TBD
TransmissionDestinationPortNumber=TBD
#
# Transmission Broadcast Interval 0.05 to 20.0 seconds for repeated broadcasts. A broadcast
interval of 0 would indicate that the payload should be dispatched immediately and only one
time.
TransmissionBroadcastInterval=0
#
# Message Delivery (broadcast) start time (UTC date and time) in the form: "mm/dd/yyyy,
hh:mm"
MessageDeliveryStart=00/00/0000, 00:00
#
# Message Delivery (broadcast) stop time (UTC date and time) in the form: "mm/dd/yyyy, hh:mm"
MessageDeliveryStop= 00/00/0000, 00:00
#
# Message Signature/Encryption
MessageSignarure=True
MessageEncryption=True
#
# Message Payload
RSEUnitID=ABC123
MessageTimeStamp=<11/30/2011,09:10:36>
RSEStatusCode=000
```

APPENDIX F: Log File Transfer Protocol

F.1 Introduction

In the context of the Safety Pilot Project, it is desired to completely lock-down the receiving side of the firewall of the most vulnerable network entities—road side equipment. The original system monitoring concept was that RSE send heartbeat status messages to the monitoring host about once every minute, and that the monitoring host could collect log files from the RSE on-demand. While outbound heartbeat status

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message will continue to operate as expected with the more secure firewall rules, on-demand log collection will not.

The System Requirement Specification for RSE¹ lists FTP as the mechanism to send log files to a configured host system in requirement SRD-USDOTRSE-002-ReqCML018v001 CML Automated Off-Load Initiation-Time Threshold. It is desired to define a simple command and response communication scheme for RSE to deliver their log files to remote storage that also leverages the existing USDOT Security Credential Management SystemDesign² procedures and the Security Credential Management System being put in place to support the Safety Pilot/Model Deployment.

Alternatively, instead of FTP, a more secure common file transfer mechanism could be used. Secure copy protocol (SCP) operates over a secure shell (SSH) connection. This will provide a secure transfer mechanism, although it will not leverage the model deployment IEEE 1609.2³ security framework and will also require a few more configuration parameters than the proposed custom file transfer protocol. Details of this approach are in its own section within this document.

F.2 1609.2 File Transfer Protocol Concept

The log file transfer protocol will consist of simple text commands exchanged through a request and response style interaction that is initiated from the perspective of RSE. Keeping the protocol simple facilitates implementation, and having human-readable text commands facilitates testing and resolving errors using system logs.

Under this proposed log file transfer mechanism, RSE must still be configured with a default monitoring host address and logical port. When RSE has log files to send, a send log request is transmitted to the monitoring host. The monitoring host responds with a delay value measured in seconds, typically zero, which can be used to manage network bandwidth.

If the specified number of seconds to delay is not zero, the RSE waits at least the delay period before starting the interaction over again with a fresh send log request. Otherwise, the log file named in the request is immediately transmitted to the monitoring host. The monitoring host responds with a send log acknowledgement that contains a hash verification code for the sent file. If the received hash verification code matches what the RSE sent, the RSE then deletes its local log file copy and the interaction is complete. Log files are processed one-at-a-time and the RSE may then proceed to attempt to send the next available log file.

If network communication is unexpectedly interrupted or an expected response is not received within a reasonable time, the RSE should terminate the communication and try again. The retry attempt does not necessarily need to be immediate. It could potentially occur naturally at the next regular upload interval.

TCP will be used for the network protocol. UDP could be used, but would require additional complexity in the protocol to break log files into blocks that could be tracked and re-sent out of order to recover from missing or corrupted pieces. Reliability is important with the larger log file transmission, whereas UDP is sufficient for the smaller and more frequent heart beat status messages.

¹ SYSTEM REQUIREMENT DESCRIPTION “5.9GHz DSRC Roadside Equipment” Device Specification, version 3.0

² CAMPVSC3 –USDOT Security Credential Management System Design, February 29, 2012

³ IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9_3-2011-09

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The send log protocol will use the security profile defined in section B.3 of the RSE requirements specification, Security Profile for Other Signed but NOT Encrypted Messages. Signing is necessary to authenticate file transfer participants. There is no personally identifiable information or other sensitive data within the log files being transmitted and additional protection through encryption may not be necessary.

There is a considerable amount of repetitive information stored within the log files. In the interest of maximizing bandwidth and local storage resources, RSE should regularly close log files, compress them, and open new ones. The default initiation time threshold is daily, but hourly segmented log files will perform better in this scenario and still support both log filename requirements SSL and CML: SRD-USDOTRSE-002-ReqSSL014v001 System Status Log Filename and SRD-USDOTRSE-002-ReqCML009v001 Communications Message Log Filename. A readily available open-source compression application, such as gzip, can be used to perform the file compression. This will significantly increase the capacity, robustness, and value of the deployed assets.

F.2.1 Information Exchange

This section proposes the specific commands used to transfer log files from an RSE to the configured monitoring host. The security profile defined in section B.3 of the RSE requirements specification applies a signature and certificate to each message for verification purposes. Details of the security mechanism used can be found in IEEE 1609.2⁴.

A file transfer transaction is initiated when a send log request is sent from the RSE to the monitoring host. The send log request will contain the configured RSE identifier (RSEUnitID), the percentage of remaining local storage, the type of log file to be received, the log file name, and the number of bytes to be transferred.

The send log response is sent from the monitoring host to the RSE and will contain a delay value measured in seconds.

The log file data stream is sent from the RSE to the monitoring host and will contain the log file source data.

The send log acknowledgement is sent from the monitoring host to the RSE and will contain the number of bytes received and a hash verification code for the log file just transmitted.

F.2.2 Messaging Detail

The message structures used for the send log application interactions match those used for signed data from the IEEE 1609.2 specification. Relevant portions of that document are reproduced here for discussion purposes.

Signed data follows this pattern:

```
struct
{
    ContentType          type;
    SignerIdentifier     signer;
    ToBeSignedData      unsigned_data;
    Signature            signature;
} SignedData;
```

⁴ IEEE P1609.2, Draft 9.3, Posted as 1609.2-v2-d9_3-2011-09

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The content type can be either 1609Dot2Data or ToBeEncrypted, but in this case will be set to be 1609Dot2Data since encryption is not necessary for this application. The signer identifier can contain several different methods of identification. For the send log application, the signer identifier can be either a complete certificate or certificate digest. See Section IEEE 1609.2, section 6.2.4 for additional detail. The send log protocol being defined will always send the complete certificate.

There are four send log protocol messages: send log request, send log response, send log data, and send log acknowledgement. All send log application messages will adhere to the structure of ToBeSignedData:

```

struct
{
    ContentType          type;
    TbsDataFlags        tf;
    Psid                 psid
    opaque               data<var>;
    Time64               generation_time;
} ToBeSignedData;

```

The content type will be inherited from the signed data structure and will be set to 1609Dot2Data. Data flags will be set to one (1), which indicates the message contains the time the message was transmitted. The included Time64 format is an eight-byte integer with a big-endian byte ordering, giving the number of microseconds since 00:00:00 UTC, 1 January, 2004. Opaque data for the send log application will begin with a four-byte integer that specifies the number of bytes contained within the opaque portion of the message, not including the four-byte count.

All send log message identifiers (PSID) will be set to the value for the send log application found in the RSE device specification. For the purposes of Safety Pilot/Model Deployment, the General IP Data Exchange identifier, 0xBFE1, will be used. This is the test value for applications other than security credential management.

The introduction section of this document states that easy-to-read text commands are desired. Each opaque section of data contains a text string of the action being taken followed by appropriately encoded parameters for the specified command. UTF-8 character encoding is implicit for text values and whitespace is not allowed. Log file data contains the binary content of the log file being transmitted as its command parameter.

The send log request message is sent from the RSE to the monitoring host and contains six parameters:

```

struct
{
    FullySpecifiedAppID  send_log_application_id;
    MessageFlags         mf;
    char[10]             send_log_request;
    char[3]              log_type;
    uint8                storage_remaining;
    uint32               bytes_to_send;
    char[]               RSEUnitID
    char[]               source_file_name;
    Time64               generation_time;
} SendLogRequestMessage;

```

`send_log_request` –a fixed-length character string containing the value **SENDLOGREQ**.

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log_type – a fixed-length character string containing the type of log file being transferred. This will be either **SSL** or **CML**.

storage_remaining – a one-byte integer indicating the percentage of storage remaining on the sending RSE where log files are saved. Values will range from 0 to 100.

bytes_to_send – a four-byte integer with big-endian byte ordering that indicates how many bytes need to be accepted.

RSEUnitID – a null-terminated character string containing the configured name of the sending RSE.

source_file_name – a null-terminated character string containing the source log file name. Example file names: **SSL-20120320-2200.log.gz**, or **CML-20120320-2230.pcap.gz**.

The send log response message is sent from the monitoring host to the RSE and includes two parameters:

```
struct
{
    FullySpecifiedAppID  send_log_application_id;
    MessageFlags         mf;
    char[10]             send_log_response;
    uint32               seconds_to_delay;
    Time64               generation_time;
} SendLogResponseMessage;
```

send_log_response – a fixed-length character string containing the value **SENDLOGRSP**.

seconds_to_delay – a four-byte integer with big-endian byte ordering indicating how many seconds the RSE should wait before attempting to send a log file. The value will typically be zero, but if it is not zero, the RSE should wait at least the specified duration of the delay before starting the send log application process over with a fresh send log request message.

The send log data message is sent from the RSE to the monitoring host and includes the command string and the log file content:

```
struct
{
    FullySpecifiedAppID  send_log_application_id;
    MessageFlags         mf;
    char[10]             send_log_data;
    uint8<length - 10>   log_file_content;
    Time64               generation_time;
} SendLogDataMessage;
```

send_log_data – a fixed-length character string containing the value **SENDLOGDAT**.

log_file_content – an array of bytes that represent the log file content being transmitted. The number of bytes being sent is the length of the opaque portion of the message excluding the length of the command string.

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The send log acknowledgement is sent from the monitoring host to the RSE to verify that the log file was received intact. It contains three parameters:

```

struct
{
    FullySpecifiedAppID  send_log_application_id;
    MessageFlags         mf;
    char[10]             send_log_ack;
    uint32               bytes_received;
    uint8[32]           log_content_hash;
    Time64               generation_time;
} SendLogAckMessage;

```

send_log_ack – a fixed-length character string containing the value **SENDLOGACK**.

bytes_received – a four-byte integer with big-endian byte ordering indicating how many bytes of the transmitted content were received. The value is used as a quick check to determine if any portion of the log file content was potentially lost during transport.

log_content_hash – a 32-byte array with big-endian byte order that contains the SHA-256 hash value generated by the monitoring host for the log file content just received in the log_file_content portion of the SendLogData message immediately prior. If the received byte count matches, the RSE compares the remotely generated hash value with its locally generated hash value to verify that the log file content was received uncorrupted. The RSE may then delete its local log file copy to free storage space for re-use.

F.3 Secure Copy Protocol Concept

The 1609.2 enabled file transfer protocol needs a single configuration parameter: destination host server address. The authentication and authorization security interactions are handled by the built-in 1609.2 certificates.

In the case of using SCP as the file transfer mechanism, a few more RSE configuration parameters are necessary:

- Destination host server address
- Destination host security key
- Destination host credentials
- Destination host file path

Destination host server address – the network address of the server that will receive log files. This parameter is needed by the RSE regardless of the implemented log file transfer protocol.

Destination host security key – the security certificate key for the host server. This is part of the SSH authorization mechanism and establishes the initial trust of the host server from the RSE. Each RSE could be configured with a pre-defined destination host key. Alternatively, the RSE could be configured to accept any offered host key. This may be reasonable default behavior for the model deployment, but automatically trusting every possible host is generally not good security practice.

Destination host credentials – the username and password expected by the host from the RSE. There are three approaches to distributing credentials: each RSE can be configured with a unique user name and password, a few sets of credentials could be grouped by RSE vendor, or use one set of global credentials. Whatever credential distribution approach is selected, the user name and password will need to be defined properly on the host.

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Destination host file path – the location on the host server where log files will be stored. The 1609.2 enabled file transfer protocol allowed the server to decide where log files would be stored. In the case of SCP, a file path pattern must be defined and configured on each RSE:

/RSE-logs/<log type>/<RSE name>/<log file name>

Log type will be SSL, CML, or some other type string not yet defined. The RSE name is configured for each RSE. The log file name will conform to the file name requirements from the RSE specification. Top level RSE-logs and subdirectories will be created on the host server with appropriate permissions applied.

F.3.1 Information Exchange

The log file transfer process will begin when either the log file size or schedule trigger occurs. The RSE will then use the destination host address, username, and password to copy each completed log file from its source location to the automatically generated destination path and filename following the previously described directory form. Each log file will be deleted from the RSE when its SCP process completes. The storage limit purging process operates independently of the log file transfer process.

F.3.2 Secure Copy Protocol Recommendations

There are a few recommendations for using SCP that augment the RSE specification requirements:

Log file schedule trigger defaults to daily. Hourly will be much better.

Log file size trigger should be between 10 and 20 megabytes. This results in a transfer time of 10 to 20 minutes in the case of cell modem equipped RSE.

Use the command line option for SCP to enable compression. This will make a significant difference in transmission time due to the repetitive nature of the log files—also very beneficial for cell modem installations.

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