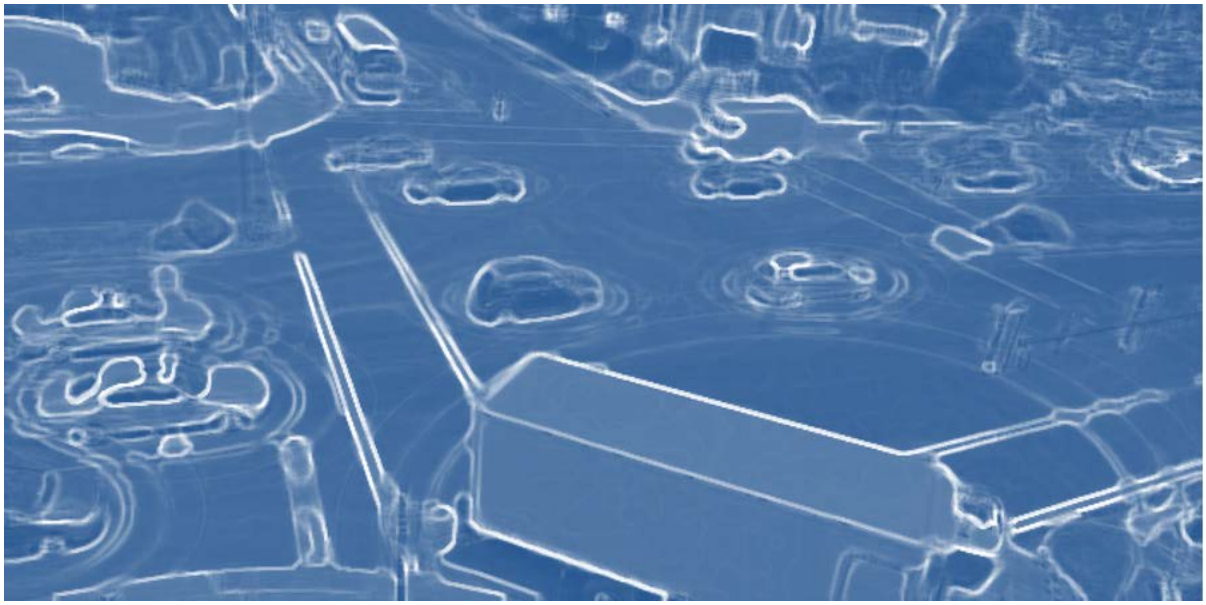

IUT Requirements

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1 Scope

This document provides the overview of the requirements for devices submitted for evaluation, testing and certification by the Certification Operating Council.

2 References

2.1 Normative References

The following referenced documents are necessary for the application of the present document.

[1] WAVE802.11-TSS&TP (V0.6.0): “Conformance test specifications for Wireless Access in Vehicular Environments (WAVE) — 802.11 Test Suite Structure and Test Purposes (TSS & TP)”. Revision date: 3/24/2016

[2] WAVEMCO-TSS&TP (V0.6.0): “Conformance test specifications for Wireless Access in Vehicular Environments (WAVE) — Multi-channel Operation Test Suite Structure and Test Purposes (TSS & TP)”. Revision date: 3/23/2016

[3] WAVENS-TSS&TP (V0.6.0): “Conformance test specifications for Wireless Access in Vehicular Environments (WAVE) — Networking Services Test Suite Structure and Test Purposes (TSS & TP)”. Revision date: 1/6/2016

[4] WAVE-16092-TSS&TP (V1.0): “Conformance test specifications for Wireless Access in Vehicular Environments (WAVE) — Security Services Test Suite Structure and Test Purposes (TSS & TP)”. Revision date: 3/23/2016

[5] J2945/1-TSS&TP (V0.4.0): “Conformance test specifications for SAE J2945/1 - On-board System Requirements for V2V Safety Communications Test Suite Structure and Test Purposes (TSS & TP)”. Revision date: 4/5/2016

[6] TCIS (V0.1.0): “Test Control Interface Specification”, Revision date: 03/21/2016.

[7] “DSRC Proxy”, V0.5.0, Revision date: 11/6/2015.

[8] IEEE Std. 802.11™-2012: “Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications”.

[9] IEEE Std 1609.3-2016 “IEEE Standard for Wireless Access in Vehicular Environments (WAVE) — Network Services”.

[10] SAE J2945/1 MAR2016: “Surface Vehicle Standard: On-board Systems Requirements for V2V Safety Communications”.

[11] IEEE Std 1609.2-2016 “IEEE Standard for Wireless Access in Vehicular Environments (WAVE) — Security Services”.

[12] IEEE Std. 1609.4-2016 “IEEE Standard for Wireless Access in Vehicular Environments (WAVE) -- Multi-Channel Operation”.

2.2 Informative References

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EG 202 798 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

[i.2] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

3 Definitions and abbreviations

3.1 Definitions

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABS Anti-lock Braking System
ASN Abstract Syntax Notation
BSM Basic Safety Message
CH Channel
CPU Central Processing Unit
DSRC Dedicated Short Range Communications
GPS Global Positioning System
ICMP Internet Control Message Protocol
IEEE Institute of Electrical and Electronics Engineers
IP Internet Protocol
ISO International Organization for Standardization
ITS Intelligent Transport Systems
IUT Implementation Under Test
OER Octet Encoding Rules
PC Personal Computer
PDU Protocol Data Unit
PSID Provider Service Identifier
RCPI Received Channel Power Indicator
RX Receive
SAE Society of Automotive Engineers
SUT System Under Test
TCI Test Control Interface (physical connection)
TCIA Tester Control Interface Application
TCP Transport Control Protocol
TP Test Purposes
TPI Tester Protocol Interface
TRI Tester Radio Interface
TS Test System
TX Transmit
UC Use Case
UDP User Datagram Protocol
WAVE Wireless Access in Vehicular Environments
WME WAVE Management Entity
WSA WAVE Service Advertisement
WSM WAVE Short Message

4 Test System

4.1 Architecture

The Test System used to support tests listed in [1], [2], [3], [4], [5] is depicted in

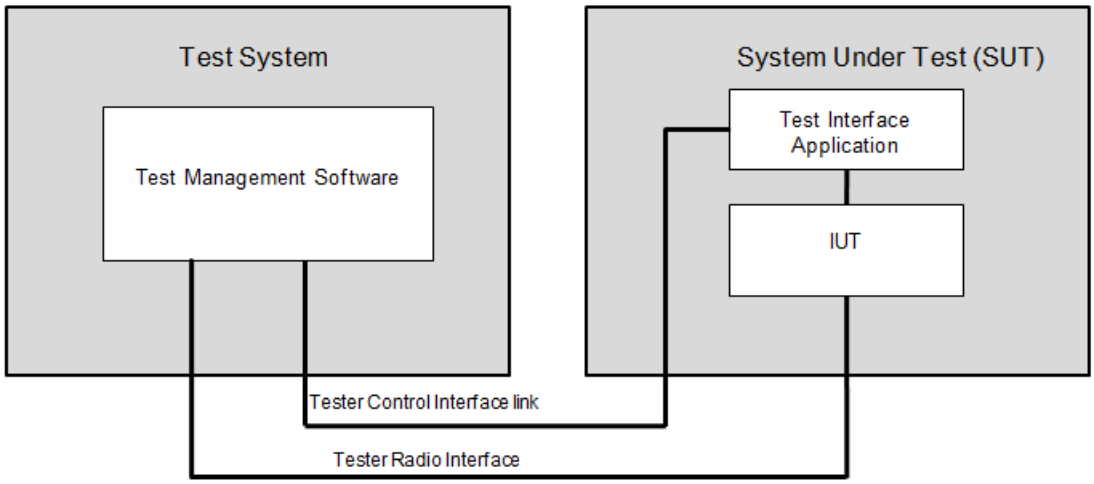

Figure 1. The test system is designed to simulate valid and invalid protocol behaviors, and analyze the reaction of the IUT.

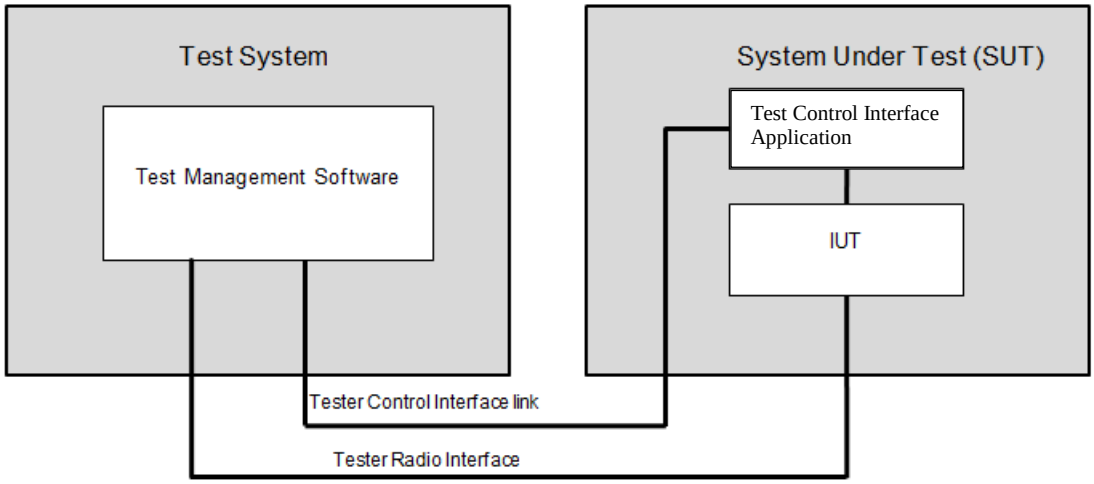

Figure 1: General Architecture

The system is implemented according to the Figure 2. The test system is comprised of a test system containing special software, a DSRC radio interface and an Ethernet interface. The test System is physically connected to the SUT via an Ethernet cable for transfer of Control and Test Data to and from the SUT and via the DSRC radio for transfer of protocol data.

The Wired Ethernet connection may be replaced by a wireless Ethernet connection if the SUT does not support a wired connection.

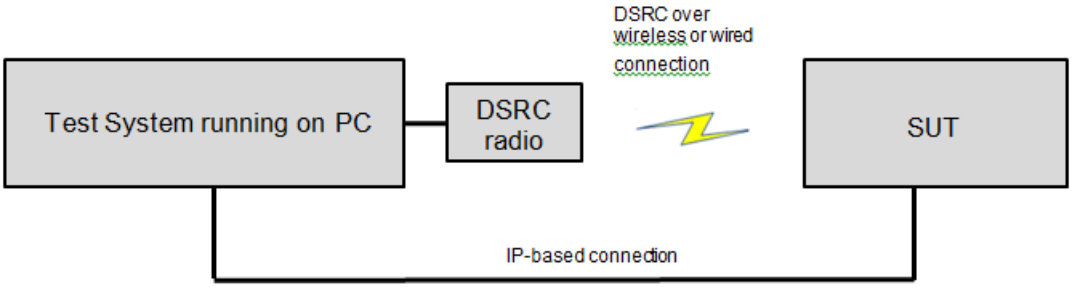

Figure 2: Test System Implementation

4.2 Test System

The main hardware component of the Test System is a standard PC. Its role is to host the execution of the test suites, manage the test flow and generate test reports. Constructing a Test System, the following points must be considered:

The Test System must be equipped with at least one Ethernet network interfaces, for exchanging Control and Test data messages with the SUT. The connection to the DSRC radio is via Ethernet port.

The interface between the Test System and the SUT is covered in a separate document [6].

4.3 DSRC radio

To monitor and test DSRC message exchanges, a DSRC radio that fully supports the IEEE 802.11 standard [[8]] is included in the Test System. The DSRC radio acts as a packet sniffer. It bridges and passes all messages to and from the Test System. The Test System performs message encoding/decoding and validation.

The DSRC Proxy is a special application software running on the DSRC radio in order to facilitate testing. It handles conversion of messages received between two interfaces: packets exchanged with the Test System via an Ethernet interface; and wireless 802.11 frames transmitted/received via the DSRC radio interface.

To support this protocol, the DSRC radio must be able to send and receive 802.11 packets using the lower-most layers of MAC and PHY software of the built-in protocol stack. The DSRC radio is not required to do decoding of wireless packets as per DSRC or IPv6 protocol.

4.4 System Under Test (SUT)

The System Under Test is comprised of the Implementation Under Test in combination with the Test Interface Application.

4.4.1 Implementation Under Test

The Implementation Under Test is represented by the device submitted for testing and validation.

The following are the requirements to the device:

4.4.1.1 Hardware

- Device must contain Ethernet interface accessible via RJ45 or USB interface supporting IPv4 over USB RNDIS interface
- Access to the GNSS and DSRC radio antenna ports via an SMA connector or pigtail shall be provided.

4.4.1.2 Software

- Device must contain Test Control Interface Application supporting interface defined in [6].

4.4.1.3 Common Time Reference

- Device must use UTC Timestamp in ms time reference whenever time is required to be included in TCI messages and for logging / diagnostics. If a received DSRC message is being forwarded over the TCI, no change to the time is required.

4.4.1.4 Capabilities

- IUT capabilities are described by a questionnaire described in Appendix A
- Answers to the questionnaire will lead toward generation of the test plan which will be created before testing begins.

4.4.1.4.1 Device Profiles

The following are categories of functionality required for different types of devices:

OBU device must support:

- Transmission of BSMs
- Reception of WSAs
- Channel switching
- IPv6 over DSRC
- Interface to SCMS

Annex A Protocol Implementation Conformance Statement (PICS) proforma

A.1 Instructions for completing the PICS proforma

A.1.1 General Instructions

This PICS proforma does not replace the individual PICS proforma included within the individual standards referenced within this proforma, these must be completed according to the instructions contained within the relevant standard and provided with the request for certification.

For this proforma, the Implementation identification and protocol summary sections shall be completed in such a way that both the supplier and implementation to be tested may be uniquely identified. If a product is capable of being configured in more than one way, a separate PICS shall be completed for each configuration to be tested. Details of the configuration shall be noted in the Additional Information section. The Additional Information section may also be used by the supplier to provide any other details necessary for the test laboratory to configure the system for testing.

The bulk of the PICS proforma is a questionnaire, divided into separate tables that pertain to differing device types, capabilities and standards.

Each row of the proforma contains a question that a device vendor must answer, in some cases a simple Yes or no is required, in other cases a value shall be provided. The number of columns varies by table, in all cases column one contains the item number and column 2 contains the question, column 3 is the reference for the question within the standard that the particular table pertains to, and column 4 is the Status column. The status column defines whether a capability is Mandatory or Optional. The vendor must answer Yes or No for all lines in this column. Where a supported value is constrained, those constraints are provided in the “Specified” column; in these cases, the values entered by the vendor into the “Supported Value” column must be limited to those values.

A.1.2 Exceptions

Should there be exceptions where a supplier cannot answer Yes for a mandatory item, a full explanation must be provided in the comments section.

A.2 PICS proforma

A.2.1 Identification

Only the first three items are required for all implementations. Other information may be completed as appropriate in meeting the requirement for full identification.

The terms *Name* and *Version* should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, and Model).

Supplier: Name: Address: Phone: Email: Additional information:
Contact point for queries about the PICS Name: Address: Phone: Email:
Implementation Name(s) and Version(s) Product model name: Hardware version: Software version:
Other information necessary for full identification, e.g., name(s) and version(s) of the machines and/or operating systems(s), system names

A.2.2 Protocol summary

Identification of protocol standard	IEEE Std 1609.x SAE J2945/1
Identification of amendments and corrigenda to this PICS proforma that have been completed as part of this PICS	Amd. : Corr. :

	Amd. : Corr. :
Have any exception items been required? (See A.3.3; the answer Yes means that the implementation does not conform to IEEE Std 1609.2)	□Yes □No
Date of statement (dd/mm/yy)	

A.2.3 Conformance statement

A.2.3.1 *Communication Services*

This presents a list of the functionality that an implementation may claim to support.

Table A. 1: Device Type Supported

Item	Device configuration (top-level)	Reference	Status	Support
1.	In-vehicle device		O	□Yes □No
2.	Roadside device		O	□Yes □No
3.	Personal communication device		O	□Yes □No

Table A. 2: Types of In-Vehicle devices

Item	Device configuration (top-level)	Reference	Status	Support
1.	ASD		O	□Yes □No
2.	VAD		O	□Yes □No
3.	ISS		O	□Yes □No
4.	RSD		O	□Yes □No

Table A. 3: Items common to all devices

Item	Device configuration (top-level)	Reference	Status	Support	Specified	Supported Value
1.	Device Class		O	□Yes □No	A, B, C, D	
2.	Operating Class		O	□Yes □No	17, 18	
3.	Number of radios		O	□Yes □No	1 or 2	
4.	Channels supported		O	□Yes □No	172, 174, 176, 178, 180, 182, 184, 175, 181	
5.	Channel feature supported by channel		O	□Yes □No	BSM, IPv6, WSA, Continuous, Alternating	
6.	10 MHz data rate supported		O	□Yes □No	3,4.5,6,9,12,18,24,27	
7.	20 MHz data rate supported		O	□Yes □No	6,9,12,18,24,36,48, 54	

Table A. 4: 2945/1 Specific Items

Item	Device configuration (top-level)	Reference	Status	Support	Supported Value in dBm
1.	*MaxTxPowerCap*		O	□Yes □No	
2.	PwrRange		O	□Yes □No	

Table A. 5: 1609.4 Specific Items

Item	Device configuration (top-level)	Reference	Status	Support
1.	TransmitterProfileTable: ServiceChannelOperatingClass ServiceChannelNumber AdaptableRate DataRate PowerLevel		O	□Yes □No

Table A. 6: Communication Direction Supported

Prerequisite: A.1				
Item	**Device configuration (top-level)**	**Reference**	**Status**	**Support**
1.	Device supports WSM transmission and reception		M	□Yes □No

Table A. 7.1: In-Vehicle Device

Prerequisite: A.1.1				
Item	**Device configuration (top-level)**	**Reference**	**Status**	**Support**
1.	Transmit BSM	[10] 6.3, 6.4.1	M	□Yes □No
2.	Receive BSM	[10] 6.4.2	O	□Yes □No
3.	Receive WSA		O	□Yes □No
4.	Security	[10] 5.1.3	M	□Yes □No
5.	Privacy	[10] 5.1.3	M	□Yes □No
6.	Positioning	[10] 5.1.2	M	□Yes □No
7.	EEBL – Lead Vehicle Decelerating	[10] 4.2.3	O	□Yes □No
8.	FCW-Forward Crash Warning	[10] 4.2.4	O	□Yes □No
9.	BSW /LCW- Blind Spot Warning/Lane Change Warning	[10] 4.2.5	O	□Yes □No
10.	IMA-Intersection Movement Assist	[10] 4.2.6	O	□Yes □No
11.	LTA - Left Turn Assist	[10] 4.2.7	O	□Yes □No
12.	CLW - Control Loss Warning	[10] 4.2.8	O	□Yes □No
13.	Transmit IPv6		O	□Yes □No
14.	Receive IPv6		O	□Yes □No

Table A. 8.2: Roadside Device

Prerequisite: A.1.2				
Item	**Device configuration (top-level)**	**Reference**	**Status**	**Support**
1.	Receive BSM		O	□Yes □No
2.	Transmit WSA		O	□Yes □No
3.	Transmit WSM		O	□Yes □No
4.	Transmit IPv6		O	□Yes □No
5.	Receive IPv6		O	□Yes □No

Table A. 9.3: Personal Communication Device

Prerequisite: A.1.3				
Item	**Device configuration (top-level)**	**Reference**	**Status**	**Support**
1.	Transmit BSM		M	□Yes □No
2.	Receive BSM		O	□Yes □No
3.	Receive WSA		O	□Yes □No

Annex B Device Definitions

B.1.1 Definitions from Safety Pilot

As taken from - http://www.its.dot.gov/factsheets/pdf/SafetyPilot_final.pdf

B.1.1.1 *VAD*

Vehicle Awareness Device – This is an aftermarket electronic device, installed in a vehicle without connection to vehicle systems, that is capable of only sending the basic safety message (BSM) over a DSRC wireless communications link. Vehicle awareness devices do not receive data from other DSRC devices and do not generate warnings. They may be used in any type of vehicle.

B.1.1.2 *ASD*

Aftermarket Safety Device (ASD) – This is an aftermarket electronic device, installed in a vehicle, and capable of sending and receiving the safety messages over a DSRC wireless communications link. The device has a driver interface, runs V2V and V2I safety applications, and issues audible or visual warnings and/or alerts to the driver of the vehicle.

B.1.1.3 *RSD*

Retrofit Safety Device – This is an electronic device installed in vehicles by an authorized service provider, at a service facility after the vehicle has completed the manufacturing process (retrofit). This type of device is connected to a vehicle databus and can provide highly accurate information from in-vehicle sensors. The integrated device has a working driver interface, both broadcasts and receives BSMs, and can process the content of received messages to provide warnings and/or alerts to the driver of the vehicle in which it is installed. These are being developed for transit vehicles and trucks.

B.1.1.4 *ISS*

Integrated Safety System – This is an electronic device inserted into vehicles during vehicle production. This type of device is connected to proprietary data busses and can provide highly accurate information using in vehicle sensors. The integrated system both broadcasts and receives BSMs and can process the content of received messages to provide warnings and/or alerts to the driver of the vehicle in which it is installed. These are being developed for light vehicles, trucks, and transit vehicles.

Revision History

V0.1.0	April 22, 2016	Initial Draft
V0.2.0	April 27, 2016	Additions to A.2.3.1
V0.3.0	April 28, 2016	Added channel details. Added device definitions in Annex B
V0.4.0	July 15, 2016	Updated references, re-wrote PICS instructions, added Time requirements, added requirement for antenna access, various other minor changes following review.

◙ End of Document ◙