Triggering Conditions and Data Quality

CAR 2 CAR Communication Consortium

Stationary Vehicle Warning

Partners of the C2C-CC

Document information

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Table 1: Document information

Open Issues

None.

Changes since last version

Title:					
Explanatory notes:					
3	2	01.12.2015	Reworked according to Change Management process and released as part of CAR 2 CAR Release 1.1.0	Volkswagen AG	
3	1	28.04.2014	Update after CAM/DENM/CDD Enap Phase	Sebastian Engel	
3	0	07.02.2014	Fixed layout and minor type faults	Sebastian Engel	
2	1	12.12.2013	Reworked Triggering Conditions and Update chapter after WG-APP meeting	Sebastian Engel	
2	0	10.10.2013	Update after Audi/VW review	Sebastian Engel	
1	4	08.08.2013	Mandatory fields in DENM table added	Sebastian Engel	
1	3	11.07.2013	Comments from WG-APP meeting inserted	Gerhard Fischer	
1	1	20.6.2013	Chapter for Geo Network Layer for the use cases added	Gerhard Fischer	
1	0	11.06.2013	First release after initial creation and review phase	Stefan Begerad	
Issue	Rev.	Date	Changes	Edited by	Approved

Table 2: Change history

Content

List of tables

1 Introduction

1.1 Abstract

Other (informational) **RS_tcSpVe_220**

This document describes the triggering conditions for stationary vehicle warning for the following three use cases:

- Stationary Vehicle Warning - Stopped Vehicle
- Stationary Vehicle Warning - Broken-down Vehicle

  Stationary Vehicle Warning - Post-Crash

2 Triggering conditions

2.1 Stationary Vehicle Warning

Requirement **RS_tcSpVe_242**

The Stationary Vehicle Warning Use Cases deals with vehicles which are "stationary". A stationary vehicle is defined as follows:

- The vehicle is moving with an absolute speed less than or equal to 8 centimeter per second. The speed shall be determined by internal vehicle sensors (e.g. wheel ticks), not by a GNSS receiver.

Details:

Detailed by:

Tested by:

2.1.1 Stationary Vehicle Warning - Stopped Vehicle

2.1.1.1 Description of Use Case

Other (informational) **RS_tcStVe_184**

This section describes the triggering of V2V messages for stopped vehicles. Various reasons could lead to a situation involving a stopped vehicle, like human problems, accidents, rubbish collection, delivery service or a stopping bus. This section focuses on situations without particular information about the reason of the stopping maneuver.

Requirement **RS_tcStVe_116**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated to be valid. Such a signal encourages the stack to either generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Details:

Detailed by:

Tested by:

2.1.1.2 Relations to other Use Cases

Other (informational) **RS_tcStVe_185**

The following use cases are related to the *Stationary Vehicle Warning - Stopped Vehicle* use case, because they share similar triggering conditions:

- Special Vehicle Warning - Stationary Wrecking Service Warning
- Stationary Vehicle Warning - Broken-down Vehicle
- Stationary Vehicle Warning - Post-Crash

2.1.1.3 Triggering Conditions

2.1.1.3.1 Preconditions

Requirement **RS_tcStVe_117**

The following preconditions shall be satisfied every time before triggering of this use case is initialised:

1. No break-down warning message, that prevents the driver from continuing driving (for example: red warning symbols, according to ECE regulation No. 121 [RD-2]), is shown on the instrument cluster.

NOTE: No requirement regarding the ignition terminal 15 is put here. However, this does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_205**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Broken-down Vehicle* and/or *Post-Crash* simultaneously, the use cases shall be prioritized as follows:

1. Post-Crash (highest priority)
2. Broken-down Vehicle
3. Stopped Vehicle (lowest priority)

Details:

Detailed by:

Tested by:

2.1.1.3.2 Use Case Specific Conditions

Requirement **RS_tcStVe_118**

Once all of the following conditions are satisfied, the triggering conditions for this use case are fulfilled and the generation of a DENM shall be triggered.

- The ego vehicle has enabled hazard lights.
- The vehicle is stationary.
- The *Triggering Timer* is expired.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_119**

The vehicle speed shall be determined by the CAN bus signal, not by GNSS. The filtered vehicle speed (with respect to sensor noise due to wheel ticks) shall be used. This requirement shall be applied for all following occurrences of vehicle speed analysis.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_120**

If the vehicle has enabled hazard lights and the vehicle is stationary, the *Triggering Timer* shall be set to 30 seconds and started. The *Triggering Timer* shall be reduced, if the following situations appear:

a. The timer shall be reduced by 10 seconds, if the automatic transmission (AUT) is set to parking for at least 3 s.
b. The timer shall be reduced by 10 seconds, if the gear box is set to idle for at least 3 s.
c. The timer shall be reduced by 10 seconds, if the parking brake is enabled for at least 3 s.
d. The timer shall be reduced by 10 seconds, if an arbitrary number of the seatbelt buckles change from "connected" to "disconnected" for at least 3 s.
e. The timer shall be set to 0, if an arbitrary number of doors are open for at least 3 s.

f. The timer shall be set to 0, if the ignition terminal is switched from on to off for at least 3 s.
g. The timer shall be set to 0, if the boot (trunk) lid is open for at least 3 s.
h. The timer shall be set to 0, if the bonnet (hood) is open for at least 3 s.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_121**

All above listed procedures for the timer reduction shall be applied only once during the initial detection. If the *Triggering Timer* has been counted down to 0, no further reduction is necessary in the current detection cycle. (chap. 2.1.1.3.2)

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_122**

During the runtime of the *Triggering Timer*, the hazard lights shall be enabled and the vehicle shall be stationary. Otherwise the detection shall be cancelled.

Details:

Detailed by:

Tested by:

2.1.1.3.3 Information Quality

Requirement **RS_tcStVe_123**

The value of the data element *informationQuality* in the DENM depends on the way the event is detected. The *informationQuality* value shall be set in the following way (highest possible value shall be used):

Event detection	Value of InformationQuality
No TC compliant implementation	unknown(0)
None of the conditions a) – h) are fulfilled.	1
At least one condition of a) – d) is fulfilled.	2
At least one condition of e) – h) is fulfilled.	3

Table 3: Information quality of "Stationary Vehicle - Stopped Vehicle"

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_124**

If the Triggering Conditions change in between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

In the update phase, only the conditions that would lead to a timer reduction shall be evaluated, but not the timer itself.

Details:

Detailed by:

Tested by:

2.1.1.4 Termination Conditions

Requirement **RS_tcStVe_125**

This use case is terminated by a cancellation of the originating ITS-S. At the termination of the use case, update DENM request shall be terminated.

Details:

Detailed by:

Tested by:

2.1.1.4.1 Cancellation

Requirement **RS_tcStVe_126**

Once at least one of the following conditions is satisfied before the time period set in the data element *validityDuration* is expired, the generation of a cancellation DENM shall be triggered.

a. The vehicle is not stationary anymore for a duration of 5 seconds.
b. The hazard lights are disabled.
c. The position of the vehicle has changed more than 500 m (e.g. by a tow away process).

NOTE: The cancellation condition does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.1.4.2 Negation

Requirement **RS_tcStVe_127**

A negation DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.1.5 Update

Requirement **RS_tcStVe_128**

If the previously detected *Stopped Vehicle* was not cancelled (chapter 2.1.1.4.1), the generation of an update DENM shall be triggered every 15 s.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_129**

In the update phase, only the triggering conditions shall be checked (further evaluation of timers shall not be executed).

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_130**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see chapter 2.1.1.8.1).

NOTE: The cancellation condition does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.1.6 Repetition Duration and Repetition Interval

Requirement **RS_tcStVe_131**

New, cancellation and update DENMs shall be repeated for a *repetitionDuration* of 15 s with a *repetitionInterval* of 1 s. Therefore the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set according to the values above.

NOTE: The *validityDuration* shall be set to 30 s. Therefore, one can prevent a gap of DENMs if the *validityDuration* of the original DENM is expired and the update has not been received yet.

NOTE: The case of managing two DENMs with the same *causeCode* from the same originating ITS-S has to be handled by the receiving ITS-S.

Details:

Detailed by:

Tested by:

2.1.1.7 Traffic class

Requirement **RS_tcStVe_132**

New, cancellation and update DENMs shall be set to *traffic class* 1.

Details:

Detailed by:

Tested by:

2.1.1.8 Message Parameter

2.1.1.8.1 DENM

Requirement **RS_tcStVe_133**

Table 4 specifies the data elements of the DENM that shall be set.

Data Field	**Value**	
	Management Container	
actionID	Identifier of a DENM.Shall be set according to [AD-3].	
detectionTime	*TimestampIts*-Timestamp at which the event is detected by the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.	
referenceTime	*TimestampIts*-Timestamp at which a new DENM, an update DENM or a cancellation DENM is generated. Shall be set according to [AD-3].	
termination	Shall not be set in case of new or update DENM. Shall be set to isCancellation(0) in case of a cancellation DENM.	
eventPosition	*ReferencePosition*. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.	
relevanceDistance	lessThan1000m(4)	
relevanceTrafficDirection	If the roadType is known the value shall be set as follows:	
	RoadType	**Direction**

<table>
<tr><td></td><td>
<table>
<tr><td>0</td><td>allTrafficDirections(0)</td></tr>
<tr><td>1</td><td>upstreamTraffic(1)</td></tr>
<tr><td>2</td><td>allTrafficDirections(0)</td></tr>
<tr><td>3</td><td>upstreamTraffic(1)</td></tr>
</table>
Otherwise, the value shall be set to allTrafficDirections(0)
</td></tr>
<tr><td>validityDuration</td><td>30 seconds</td></tr>
<tr><td>stationType</td><td>The type of the originating ITS-S. Shall be set according to [AD-3].</td></tr>
<tr><td colspan="2">Situation Container</td></tr>
<tr><td>informationQuality</td><td>See Chapter 2.1.1.3.3. Shall be refreshed for every update DENM</td></tr>
<tr><td>causeCode</td><td>stationaryVehicle(94)</td></tr>
<tr><td>subCauseCode</td><td>unavailable(0)</td></tr>
<tr><td colspan="2">Location Container</td></tr>
<tr><td>eventSpeed</td><td>Speed of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>eventPositionHeading</td><td>Heading of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>traces</td><td>PathHistory of the originating ITS-S. Shall be set according to [AD-3].
If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value according to [AD-3], the PathDeltaTime shall not be further refreshed.
If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.</td></tr>
<tr><td>roadType</td><td>RoadType of the road the detecting ITS-S is situated on.
Shall be refreshed for an update DENM.
Shall be set according to [AD-3] in combination with the following rules:
<table>
<tr><th>Urban / Non-Urban</th><th>Structural Separation</th><th>Data Element</th></tr>
<tr><td>Urban</td><td>No</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr>
<tr><td>Urban</td><td>Yes</td><td>urban-WithStructuralSeparationToOppositeLanes(1)</td></tr>
<tr><td>Urban</td><td>unknown</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr>
<tr><td>Non-Urban</td><td>No</td><td>nonUrban-NoStructuralSeparationToOppositeLanes(2)</td></tr>
<tr><td>Non-Urban</td><td>Yes</td><td>nonUrban-WithStructuralSeparationToOppositeLanes(3)</td></tr>
<tr><td>Non-Urban</td><td>Unknown</td><td>nonUrban-NoStructuralSeparationToOppositeLanes(2)</td></tr>
</table>
Otherwise, if the information about the urban/non-urban status cannot be determined, the data element shall be omitted.</td></tr>
</table>

Alacarte Container	
lanePosition	If the lanePosition is provided by an onboard sensor (e.g. radar, camera), the value shall be set according to [AD-3]. The use of GPS and a digital map for the estimation of the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.
Alacarte Container: StationaryVehicleContainer	
stationarySince	Shall be set according to the duration in minutes of the detecting ITS-S being stationary.Shall be set according to [AD-3]. Shall be refreshed for an update DENM.

Table 4: DENM data elements of "Stationary Vehicle Warning - Stopped Vehicle"

Details:

Detailed by:

Tested by:

2.1.1.8.2 CAM

Requirement **RS_tcStVe_134**

CAM adaption shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.1.9 Networking and Transport Layer

Requirement **RS_tcStVe_135**

For the Day One version of this application, the destination area is the same as the relevance area - in this case, a circle of radius *relevanceDistance*. Therefore, the interface parameter *DENM destination area* between the DEN basic service and the Networking & Transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_136**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to the maximum value, according to [AD-4]. This indicates that the receiver shall hop this message. The *Advanced forwarding algorithm for GeoBroadcast*, according to [AD-4], shall be used.

Details:

Detailed by:

Tested by:

2.1.1.10 Security Layer

Requirement **RS_tcStVe_137**

If the triggering conditions as described in chapter 2.1.1.3 apply, a pseudonym (ID) change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* is

not expired (see chapter 2.1.1.8.1). Corresponding new, update and cancellation DENMs shall be sent with the same pseudonym.

Details:

Detailed by:

Tested by:

2.1.1.11 Scenarios

Other (informational) **RS_tcStVe_186**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present use case:

Count	Description	Status
	tbd.	
	tbd.	

Table 5: Stationary Vehicle Warning - Stopped Vehicle scenarios

2.1.1.12 Open Issues

Other (informational) **RS_tcStVe_188**

This section has an informational character and is not part of the requirement specification.

a) The position information are not changed during the update cycle. This is because the heading could be erroneous after longer standing times. To keep the data consistent, none of the position data are updated. However, an update could be useful if the vehicle has moved to another lane. This should be regarded in future versions.

b) The first gear could also be considered in condition b) of chapter 2.1.1.3.2.

c) The following issue shall be incorporated into the profile document: “Keep-Alive-Forwarding shall not be used.”.

2.1.1.13 Feature Requests

Other (informational) **RS_tcStVe_189**

This section has an informational character and is not part of the requirement specification.

The following list encompasses feature requests for upcoming document releases:

a) None.

2.1.2 Stationary Vehicle Warning - Broken-down Vehicle

2.1.2.1 Description of Use Case

Other (informational) **RS_tcStVe_190**

This section describes the triggering of V2V messages for broken-down vehicles. Though various reasons could cause a vehicle break-down, like bursting tyres, lack of fuel or engine failure, this section focuses on reasons indicated by a break-down warning messages in the instrument cluster.

Requirement **RS_tcStVe_138**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated to be valid. Such a signal encourages the stack to either generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Details:

Detailed by:

Tested by:

2.1.2.2 Relations to other Use Cases

Other (informational) **RS_tcStVe_191**

The following use cases are related to the *Stationary Vehicle Warning - Broken-down Vehicle* use case, because they share similar triggering conditions:

- Special Vehicle Warning - Stationary Wrecking Service Warning
- Stationary Vehicle Warning - Stopped Vehicle
- Stationary Vehicle Warning - Post-Crash

2.1.2.3 Triggering Conditions

2.1.2.3.1 Preconditions

Requirement **RS_tcStVe_139**

The following precondition shall be satisfied every time before triggering of this use case is initialised:

1. A break-down warning message, that prevents the driver of continuing driving (for example: red warning symbols, according to ECE regulation No. 121 [RD-2]), is shown on the instrument cluster.

NOTE: No requirement regarding the ignition terminal 15 is put here. However, this does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_206**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Stopped Vehicle* and/or *Post-Crash* simultaneously, the use cases shall be prioritized as follows:

1. Post-Crash (highest priority)
2. Broken-down Vehicle
3. Stopped Vehicle (lowest priority)

Details:

Detailed by:

Tested by:

2.1.2.3.2 Use Case Specific Conditions

Requirement **RS_tcStVe_140**

Once all of the following conditions are satisfied, the triggering conditions for this use case are fulfilled and the generation of a DENM shall be triggered.

- The ego vehicle has enabled hazard lights.
- The vehicle is stationary.
- The *Triggering Timer* is expired.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_141**

The vehicle speed shall be determined by the CAN bus signal, not by GNSS. The filtered vehicle speed (with respect to sensor noise due to wheel ticks) shall be used. This requirement shall be applied for all following occurrences of vehicle speed analysis.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_142**

If the vehicle has enabled hazard lights and the vehicle is stationary, the *Triggering Timer* shall be set to 30 seconds and started. The *Triggering Timer* shall be reduced, if the following situations appear:

a. The timer shall be reduced by 10 seconds, if the automatic transmission (AUT) is set to parking for at least 3 s.
b. The timer shall be reduced by 10 seconds, if the gear box is set to idle for at least 3 s.
c. The timer shall be reduced by 10 seconds, if the parking brake is enabled for at least 3 s.
d. The timer shall be reduced by 10 seconds, if an arbitrary number of the seatbelt buckles change from "connected" to "disconnected" for at least 3 s.
e. The timer shall be set to 0, if an arbitrary number of doors are open for at least 3 s.
f. The timer shall be set to 0, if the ignition terminal is switched from on to off for at least 3 s.
g. The timer shall be set to 0, if the boot (trunk) lid is open for at least 3 s.
h. The timer shall be set to 0, if the bonnet (hood) is open for at least 3 s.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_143**

All above listed procedures for the timer reduction shall be applied only once during the initial detection. If the *Triggering Timer* has been counted down to 0, no further reduction is necessary in the current detection cycle.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_144**

During the runtime of the *Triggering Timer*, the hazard lights shall be enabled and the vehicle shall be stationary all the time. Otherwise the detection shall be cancelled.

Details:

Detailed by:

Tested by:

2.1.2.3.3 Information Quality

Requirement **RS_tcStVe_145**

The value of the data element *informationQuality* in the DENM depends on the way the event is detected. The *informationQuality* value shall be set in the following way (highest possible value shall be used):

Event detection	Value of InformationQuality
No TC compliant implementation	unknown(0)
None of the conditions a) – h) are fulfilled.	1
At least one condition of a) – d) is fulfilled.	2
At least one condition of e) – h) is fulfilled.	3

Table 6: Information quality of "Stationary Vehicle - Broken-down Vehicle"

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_146**

If the Triggering Conditions change in between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

In the update phase, only the conditions that would lead to a timer reduction shall be evaluated, but not the timer itself.

Details:

Detailed by:

Tested by:

2.1.2.4 Termination Conditions

Requirement **RS_tcStVe_147**

This use case is terminated by a cancellation of the originating ITS-S. At the termination of the use case, update DENM request shall be terminated.

Details:

Detailed by:

Tested by:

2.1.2.4.1 Cancellation

Requirement **RS_tcStVe_148**

Once at least one of the following conditions is satisfied before the time period set in the data element *validityDuration* is expired, the generation of a cancellation DENM shall be triggered.

a. The ego vehicle is not stationary anymore for a duration of 5 seconds.
b. The hazard lights are disabled.
c. The position of the vehicle has changed more than 500 m (e.g. by a tow away process).

NOTE: The cancellation condition does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.2.4.2 Negation

Requirement **RS_tcStVe_149**

A negation DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.2.5 Update

Requirement **RS_tcStVe_150**

If the previously detected *Broken-down Vehicle* was not cancelled (chapter 2.1.2.4.1), the generation of an update DENM shall be triggered every 15 s.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_151**

In the update phase, only the triggering conditions shall be checked (further evaluation of timers shall not be executed).

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_152**

In case the ignition terminal 15 is switched from on to off, an update DENM shall be triggered immediately.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_153**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see chapter 2.1.2.8.1).

NOTE: The update condition does not imply that a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.2.6 Repetition Duration and Repetition Interval

Requirement **RS_tcStVe_154**

New, cancellation and update DENMs shall be repeated for a *repetitionDuration* of 15 s with a *repetitionInterval* of 1 s. Therefore the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set according to the values above.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_155**

In case of an enabled ignition terminal 15, the *validityDuration* shall be set to 30 s. Therefore, one can prevent a gap of DENMs if the *validityDuration* of the original DENM is expired and the update has not been received yet.

NOTE: The *validityDuration* in the case of a disabled ignition terminal 15 is set to a higher value compared to the enabled ignition terminal 15 case. This is due to the fact, that update DENM cannot be triggered and not sent any longer in this case. Therefore the last DENM shall be kept alive longer.

NOTE: The case of managing two DENMs with the same *causeCode* from the same originating ITS-S has to be handled by the receiving ITS-S.

Details:

Detailed by:

Tested by:

2.1.2.7 Traffic class

Requirement **RS_tcStVe_156**

New, cancellation and update DENMs shall be set to *traffic class* 1.

Details:

Detailed by:

Tested by:

2.1.2.8 Message Parameter

2.1.2.8.1 DENM

Requirement **RS_tcStVe_157**

Table 7 specifies the data elements of the DENM that shall be set.

Data Field	Value
Management Container	
actionID	Identifier of a DENM.Shall be set according to [AD-3].
detectionTime	*TimestampIts*-Timestamp at which the event is detected by the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
referenceTime	*TimestampIts*-Timestamp at which a new DENM, an update DENM or a cancellation DENM is generated. Shall be set according to [AD-3].
termination	Shall not be set in case of new or update DENM. Shall be set to isCancellation(0) in case of a cancellation DENM.
eventPosition	*ReferencePosition*. Shall be set according to [AD-3].

<table>
<tr><td></td><td>Shall be refreshed for an update DENM.</td></tr>
<tr><td>relevanceDistance</td><td>lessThan1000m(4)</td></tr>
<tr><td>relevanceTrafficDirection</td><td>If the roadType is known the value shall be set as follows:
<table>
<tr><th>RoadType</th><th>Direction</th></tr>
<tr><td>0</td><td>allTrafficDirections(0)</td></tr>
<tr><td>1</td><td>upstreamTraffic(1)</td></tr>
<tr><td>2</td><td>allTrafficDirections(0)</td></tr>
<tr><td>3</td><td>upstreamTraffic(1)</td></tr>
</table>
Otherwise, the value shall be set to allTrafficDirections(0)</td></tr>
<tr><td>validityDuration</td><td>• Ignition terminal 15 enabled: 30 seconds
• Ignition terminal 15 disabled: 900 seconds</td></tr>
<tr><td>stationType</td><td>The type of the originating ITS-S. Shall be set according to [AD-3].</td></tr>
<tr><td colspan="2">Situation Container</td></tr>
<tr><td>informationQuality</td><td>See Chapter 2.1.2.3.3. Shall be refreshed for every update DENM</td></tr>
<tr><td>causeCode</td><td>stationaryVehicle(94)</td></tr>
<tr><td>subCauseCode</td><td>vehicleBreakdown(2)</td></tr>
<tr><td colspan="2">Location Container</td></tr>
<tr><td>eventSpeed</td><td>Speed of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>eventPositionHeading</td><td>Heading of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>traces</td><td>PathHistory of the originating ITS-S. Shall be set according to [AD-3].
If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value according to [AD-3], the PathDeltaTime shall not be further refreshed.
If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.</td></tr>
<tr><td>roadType</td><td>RoadType of the road the detecting ITS-S is situated on.
Shall be refreshed for an update DENM.
Shall be set according to [AD-3] in combination with the following rules:
<table>
<tr><th>Urban / Non-Urban</th><th>Structural Separation</th><th>Data Element</th></tr>
<tr><td>Urban</td><td>No</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr>
<tr><td>Urban</td><td>Yes</td><td>urban-WithStructuralSeparationToOppositeLanes(1)</td></tr>
<tr><td>Urban</td><td>Unknown</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr>
<tr><td>Non-Urban</td><td>No</td><td>nonUrban-NoStructuralSeparationToOppositeLanes(2)</td></tr>
<tr><td>Non-Urban</td><td>Yes</td><td>nonUrban-WithStructuralSeparationToOppositeLanes(3)</td></tr>
</table></td></tr>
</table>

	Non-Urban	Unknown	nonUrban-NoStructuralSeparationToOppositeLanes(2)
	Otherwise, if the information about the urban/non-urban status cannot be determined, the data element shall be omitted.		
Alacarte Container			
lanePosition	If the lanePosition is provided by an onboard sensor (e.g. radar, camera), the value shall be set according to [AD-3]. The use of GPS and a digital map for the estimation of the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.		
Alacarte Container: StationaryVehicleContainer			
stationarySince	Shall be set according to the duration in minutes of the detecting ITS-S being stationary.Shall be set according to [AD-3]. Shall be refreshed for an update DENM.		

Table 7: DENM data elements of "Stationary Vehicle Warning - Broken-down Vehicle"

Details:

Detailed by:

Tested by:

2.1.2.8.2 CAM

Requirement **RS_tcStVe_158**

CAM adaption shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.2.9 Networking and Transport Layer

Requirement **RS_tcStVe_159**

For the Day One version of this application, the destination area is the same as the relevance area - in this case, a circle of radius *relevanceDistance*. Therefore, the interface parameter *DENM destination area* between the DEN basic service and the Networking & Transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_160**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to the maximum value, according to [AD-4]. This indicates that the receiver shall hop this message. The *Advanced forwarding algorithm for GeoBroadcast*, according to [AD-4], shall be used.

Details:

Detailed by:

Tested by:

2.1.2.10 Security Layer

Requirement **RS_tcStVe_161**

If the triggering conditions as described in chapter 2.1.2.3 apply, a pseudonym (ID) change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* is not expired (see chapter 2.1.2.8.1). Corresponding new, update and cancellation DENMs shall be sent with the same pseudonym.

Details:

Detailed by:

Tested by:

2.1.2.11 Scenarios

Other (informational) **RS_tcStVe_192**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present use case:

Count	Description	Status
	tbd.	
	tbd.	

Table 8: Stationary Vehicle Warning - Broken-down Vehicle scenarios

2.1.2.12 Open Issues

Other (informational) **RS_tcStVe_193**

This section has an informational character and is not part of the requirement specification.

a) The position information are not changed during the update cycle. This is because the heading could be erroneous after longer standing times. To keep the data consistent, none of the position data are updated. However, an update could be useful if the vehicle has moved to another lane. This should be regarded in future versions.

b) The first gear could also be considered in condition b) of chapter 2.1.2.3.2.

c) The following issue shall be incorporated into the profile document: “Keep-Alive-Forwarding shall not be used.”.

2.1.2.13 Feature Requests

Other (informational) **RS_tcStVe_194**

This section has an informational character and is not part of the requirement specification.

The following list encompasses feature requests for upcoming document releases:

a) None.

2.1.3 Stationary Vehicle Warning - Post-Crash

2.1.3.1 Description of Use Case

Other (informational) **RS_tcStVe_195**

This section describes the triggering conditions for a V2V DENM transmission caused by a traffic accident.

Requirement **RS_tcStVe_162**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated to be valid. Such a signal encourages the stack to either generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Details:

Detailed by:

Tested by:

2.1.3.2 Relations to other Use Cases

Other (informational) **RS_tcStVe_196**

The following use cases are related to the *Stationary Vehicle Warning - Post-Crash* use case, because they share similar triggering conditions:

- Stationary Vehicle Warning - Stopped Vehicle
- Stationary Vehicle Warning - Broken-down Vehicle

2.1.3.3 Triggering Conditions

2.1.3.3.1 Preconditions

Requirement **RS_tcStVe_163**

No precondition shall be satisfied for this use case.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_207**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Stopped Vehicle* and/or *Broken-down Vehicle* simultaneously, the use cases shall be prioritized as follows:

1. Post-Crash (highest priority)
2. Broken-down Vehicle
3. Stopped Vehicle (lowest priority)

Details:

Detailed by:

Tested by:

2.1.3.3.2 Use Case Specific Conditions

Requirement **RS_tcStVe_164**

Once at least one of the following conditions is satisfied, the triggering conditions for this use case are fulfilled and the generation of a DENM shall be triggered.

a. An eCall has been triggered manually by an occupant of the vehicle by the eCall button. The maximum time span between the triggering of the eCall button and the stopping of the vehicle is 15 s.
b. A low severity crash is detected without the activation of an irreversible occupant restraint system (e.g. high-voltage battery cut-off, door unlock). The maximum time span between the detection of the low severity crash and the stopping of the vehicle is 15 s.
c. A pedestrian collision is detected with the activation of at least one irreversible pedestrian protection system (e.g. pop up engine hood, outside airbag). The maximum time span between the detection of the pedestrian collision and the stopping of the vehicle is 15 s.
d. A high severity crash is detected with the activation of at least one irreversible occupant restraint system (e.g. pyrotechnic belt-tightener, airbag).

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_165**

The vehicle speed shall be determined by the CAN bus signal, not by GNSS. The filtered vehicle speed (with respect to sensor noise due to wheel ticks) shall be used. This requirement shall be applied for all following occurrences of vehicle speed analysis.

NOTE: The conditions have only to be checked, if the necessary power supply is present. This means a crash secure implementation of the system is not required.

Details:

Detailed by:

Tested by:

2.1.3.3.3 Information Quality

Requirement **RS_tcStVe_166**

The value of the data element *informationQuality* in the DENM depends on the way the event is detected. The *informationQuality* value shall be set in the following way (highest possible value shall be used):

Event detection	Value of InformationQuality
No TC compliant implementation	unknown(0)
Condition a) is fulfilled.	1
Condition b) or c) is fulfilled.	2
Condition d) is fulfilled.	3

Table 9: Information quality of "Stationary Vehicle - Post-Crash"

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_167**

If the Triggering Conditions change in between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

Details:

Detailed by:

Tested by:

2.1.3.4 Termination Conditions

Requirement **RS_tcStVe_168**

This use case is terminated by a cancellation of the originating ITS-S. At the termination of the use case, update DENM request shall be terminated.

Details:

Detailed by:

Tested by:

2.1.3.4.1 Cancellation

Requirement **RS_tcStVe_169**

Once at least one of the following conditions is satisfied before the time period set in the data element *validityDuration* is expired, the generation of a cancellation DENM shall be triggered.

a. The ego vehicle is not stationary for a duration of 15 seconds.
b. The position of the vehicle has changed more than 500 m (e.g. by a tow away process).

NOTE: The cancellation condition does not imply that a crash secure implementation, a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.3.4.2 Negation

Requirement **RS_tcStVe_170**

A negation DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.3.5 Update

Requirement **RS_tcStVe_171**

An update DENM shall be triggered every 60 s if the use case has not been cancelled.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_172**

In case the ignition terminal 15 is switched from on to off, an update DENM shall be triggered immediately.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_173**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see chapter 2.1.3.8.1).

NOTE: The update condition does not imply that a crash secure implementation, a clamp 30 ECU or after run time is required in this case.

Details:

Detailed by:

Tested by:

2.1.3.6 Repetition Duration and Repetition Interval

Requirement **RS_tcStVe_174**

New, cancellation and update DENMs shall be repeated for a *repetitionDuration* of 60s with a *repetitionInterval* of 1 s. Therefore the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set according to the values above.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_175**

In case of an enabled ignition terminal 15, the *validityDuration* shall be set to 180 s. Therefore, one can prevent a gap of DENMs if the *validityDuration* of the original DENM is expired and the update has not been received yet.

NOTE: The *validityDuration* in the case of a disabled ignition terminal 15 is set to a higher value compared to the enabled ignition terminal 15 case. This is due to the fact, that update DENM cannot be triggered and not sent any longer in this case. Therefore the last DENM shall be kept alive longer.

NOTE: The case of managing two DENMs with the same *causeCode* from the same originating ITS-S has to be handled by the receiving ITS-S.

Details:

Detailed by:

Tested by:

2.1.3.7 Traffic class

Requirement **RS_tcStVe_176**

New, cancellation and update DENMs shall be set to *traffic class* 1.

Details:

Detailed by:

Tested by:

2.1.3.8 Message Parameter

2.1.3.8.1 DENM

Requirement **RS_tcStVe_177**

Table 10 specifies the data elements of the DENM that shall be set.

Data Field	Value
Management Container	
actionID	Identifier of a DENM.Shall be set according to [AD-3].
detectionTime	*TimestampIts*-Timestamp at which the event is detected by the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.

<table>
<tr><td>referenceTime</td><td>TimestampIts-Timestamp at which a new DENM, an update DENM or a cancellation DENM is generated. Shall be set according to [AD-3].</td></tr>
<tr><td>termination</td><td>Shall not be set in case of new or update DENM. Shall be set to isCancellation(0) in case of a cancellation DENM.</td></tr>
<tr><td>eventPosition</td><td>ReferencePosition. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>relevanceDistance</td><td>lessThan5km(5)</td></tr>
<tr><td>relevanceTrafficDirection</td><td>If the roadType is known the value shall be set as follows:
<table>
<tr><th>RoadType</th><th>Direction</th></tr>
<tr><td>0</td><td>allTrafficDirections(0)</td></tr>
<tr><td>1</td><td>upstreamTraffic(1)</td></tr>
<tr><td>2</td><td>allTrafficDirections(0)</td></tr>
<tr><td>3</td><td>upstreamTraffic(1)</td></tr>
</table>
Otherwise, the value shall be set to allTrafficDirections(0)</td></tr>
<tr><td>validityDuration</td><td>• Ignition terminal 15 enabled: 180 seconds
• Ignition terminal 15 disabled: 1800 seconds</td></tr>
<tr><td>stationType</td><td>The type of the originating ITS-S. Shall be set according to [AD-3].</td></tr>
<tr><td colspan="2">Situation Container</td></tr>
<tr><td>informationQuality</td><td>See Chapter 2.1.3.3.3. Shall be refreshed for every update DENM</td></tr>
<tr><td>causeCode</td><td>stationaryVehicle(94)</td></tr>
<tr><td>subCauseCode</td><td>postCrash(3)</td></tr>
<tr><td colspan="2">Location Container</td></tr>
<tr><td>eventSpeed</td><td>Speed of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>eventPositionHeading</td><td>Heading of the originating ITS-S. Shall be set according to [AD-3].
Shall be refreshed for an update DENM.</td></tr>
<tr><td>traces</td><td>PathHistory of the originating ITS-S. Shall be set according to [AD-3].
If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value according to [AD-3], the PathDeltaTime shall not be further refreshed.
If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.</td></tr>
<tr><td>roadType</td><td>RoadType of the road the detecting ITS-S is situated on.
Shall be refreshed for an update DENM.
Shall be set according to [AD-3] in combination with the following rules:
<table>
<tr><th>Urban / Non-Urban</th><th>Structural Separation</th><th>Data Element</th></tr>
<tr><td>Urban</td><td>No</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr>
<tr><td>Urban</td><td>Yes</td><td>urban-WithStructuralSeparationToOppositeLanes(1)</td></tr>
</table></td></tr>
</table>

	Urban	Unknown	urban-NoStructuralSeparationToOppositeLanes(0)
	Non-Urban	No	nonUrban-NoStructuralSeparationToOppositeLanes(2)
	Non-Urban	Yes	nonUrban-WithStructuralSeparationToOppositeLanes(3)
	Non-Urban	Unknown	nonUrban-NoStructuralSeparationToOppositeLanes(2)
	Otherwise, if the information about the urban/non-urban status cannot be determined, the data element shall be omitted.		
Alacarte Container			
lanePosition	If the lanePosition is provided by an onboard sensor (e.g. radar, camera), the value shall be set according to [AD-3]. The use of GPS and a digital map for the estimation of the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.		
Alacarte Container: StationaryVehicleContainer			
stationarySince	Shall be set according to the duration in minutes of the detecting ITS-S being stationary.Shall be set according to [AD-3]. Shall be refreshed for an update DENM.		

Table 10: DENM data elements of "Stationary Vehicle Warning - Post-Crash"

Details:

Detailed by:

Tested by:

2.1.3.8.2 CAM

Requirement **RS_tcStVe_178**

CAM adaption shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.3.9 Networking and Transport Layer

Requirement **RS_tcStVe_179**

For the Day One version of this application, the destination area is the same as the relevance area - in this case, a circle of radius *relevanceDistance*. Therefore, the interface parameter *DENM destination area* between the DEN basic service and the Networking & Transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Details:

Detailed by:

Tested by:

Requirement **RS_tcStVe_180**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to the maximum value, according to [AD-4]. This indicates that the receiver shall hop this message. The *Advanced forwarding algorithm for GeoBroadcast*, according to [AD-4], shall be used.

Details:

Detailed by:

Tested by:

2.1.3.10 Security Layer

Requirement **RS_tcStVe_181**

If the triggering conditions as described in chapter 2.1.3.3 apply, a pseudonym (ID) change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* is not expired (see chapter 2.1.3.8.1). Corresponding new, update and cancellation DENMs shall be sent with the same pseudonym.

Details:

Detailed by:

Tested by:

2.1.3.11 Scenarios

Other (informational) **RS_tcStVe_197**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present use case:

Count	Description	Status
	tbd.	
	tbd.	

Table 11: Stationary Vehicle Warning - Post-Crash scenarios

2.1.3.12 Open Issues

Other (informational) **RS_tcStVe_198**

This section has an informational character and is not part of the requirement specification.

a) The position information are not changed during the update cycle. This is because the heading could be erroneous after longer standing times. To keep the data consistent, none of the position data are updated. However, an update could be useful if the vehicle has moved to another lane. This should be regarded in future versions.

b) The following issue shall be incorporated into the profile document: “Keep-Alive-Forwarding shall not be used.”.

2.1.3.13 Feature Requests

Other (informational) **RS_tcStVe_199**

This section has an informational character and is not part of the requirement specification.

The following list encompasses feature requests for upcoming document releases:

a) None.

3 Appendix

3.1 List of abbreviations

Other (informational) **RS_tcStVe_200**

ABS	Anti-lock Breaking System
ASN.1	Abstract Syntax Notation One
ASR	Anti-Slip Regulation
AUT	Automatic Transmission
CAM	Cooperative Awareness Message
C2C-CC	Car to Car Communication Consortium
CDD	Common Data Dictionary
DEN	Decentralized Environmental Notification
DENM	DEN Message
ECE	Economic Commission for Europe
ETSI	European Telecommunications Standards Institute
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ITS	Intelligent Transport System
ITS-S	ITS Station
KAF	Keep-Alive Forwarding
TC	Triggering Conditions
TTC	Time To Collision

Table 12: Abbreviations

3.2 Applicable documents

Other (informational) **RS_tcStVe_201**

[AD-1]	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service Draft ETSI EN 302 637-3 V1.2.7 (2014-07)
[AD-2]	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service Draft ETSI EN 302 637-2 V1.3.5 (2014-06)
[AD-3]	Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary; ETSI TS 102 894-2 V1.1.2 (2014-07)
[AD-4]	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality Draft ETSI EN 302 636-4-1 V1.0.2 (2013-09)

Table 13: Applicable documents

3.3 Related documents

Other (informational) **RS_tcStVe_202**

[RD-1]	CAR 2 CAR Communication Consortium Triggering Conditions and Data Quality: Special Vehicle Warning
[RD-2]	Regulation No 121 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform provisions concerning the approval of vehicles with regard to the location and identification of hand controls, tell-tales and indicators

Table 14: Related documents