Triggering Conditions and Data Quality
CAR 2 CAR Communication Consortium

Dangerous Situation

Partners of the C2C-CC

Document information

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Table 1: Document information

Changes since last version

Title:					
Explanatory notes:					

Issue	Rev.	Date	Changes	Edited by	Approved
3	3	01.12.2015	Reworked according to Change Management process and released as part of CAR 2 CAR Release 1.1.0	Volkswagen AG	
3	2	26.06.2014	Correction Usecase-specific conditions automatic emergency brake	Klaus Krumbiegel	
3	1	05.05.2014	Correction regarding ASN.1-changes	Klaus Krumbiegel	
3	0	06.02.2014	Small corrections	Klaus Krumbiegel	
2	3	19.12.2013	Update after review by Conti/Opel and Denso	Klaus Krumbiegel	
2	2	13.12.2013	Comments included	Klaus Krumbiegel	
2	1	27.11.2013	Proposal for the validation of the signals representing the use case incorporated	Klaus Krumbiegel	
2	0	27.08.2013	Comments incorporated, Appendix chapters "Scenarios", "Open issues", "Features" inserted	Klaus Krumbiegel	
1	3	06.08.2013	Comments incorporated	Klaus Krumbiegel	
1	2	24.07.2013	Message table updated	Klaus Krumbiegel	
1	1	18.07.2013	General comments from WG-APP meeting inserted	Gerhard Fischer	
1	0	10.06.2010	First release after initial creation and review phase.	Dr. K. Krumbiegel	

Table 2: Change history

Open Issues

None.

Content

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1 Introduction

1.1 Abstract

Other (informational)   **RS_tcDaSi_216**

This document describes the triggering conditions for dangerous situations detected by an intervention of active safety systems for the following three use cases:

- Dangerous Situations - Electronic Emergency Brake Light
- Dangerous Situations - Automatic Brake Intervention
- Dangerous Situations - Occupant Restraint System Intervention

2   Triggering conditions

2.1   Dangerous Situations

Other (informational)   **RS_tcDaSi_217**

In day to day traffic the traffic participants are subject to a variety of driving challenges which tend to complicate the driving task. If these so called dangerous situations (i.e. driving challenges) are addressed in advance (i.e. even before the vehicle enters the danger zone), that would mean a significant gain in safety. The current sophistications, in terms of vehicle to vehicle communication allow the vehicle which is already in a danger zone to communicate the possible danger to other participants of the surrounding traffic. The driver of recipient vehicle can negotiate the oncoming danger through an appropriate driving behaviour and an increased attentiveness.

Active safety functions support the driver of ego-vehicle by intervening when detecting a dangerous situation in order to avoid or to mitigate the consequences of an imminent collision. In instances of multiple interventions by several safety systems, a priority has to be made as to which intervening function must be considered.

2.1.1   Dangerous Situations - Electronic Emergency Brake Light

2.1.1.1 Description of Use Case

Other (informational)   **RS_tcDaSi_218**

This use case consists of triggering a DENM due to an emergency brake by driver, e.g. as a reaction to a stationary or slower front vehicle. The ego vehicle itself turns into a possible local danger zone.

2.1.1.2 Relations to other Use Cases

Other (informational)   **RS_tcDaSi_219**

The following use cases are related to the *Dangerous Situations - Electronic Emergency Brake Light* use case, because they share similar triggering conditions:

- Dangerous Situations - Automatic Brake Intervention
- Dangerous Situations - Reversible Occupant Restraint System Intervention

2.1.1.3 Triggering Conditions

2.1.1.3.1 Preconditions

Requirement   **RS_tcDaSi_238**

No precondition shall be satisfied for this use case.

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_165**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Automatic Brake Intervention* and/or *Reversible Occupant Restraint System Intervention* simultaneously, the use cases shall be prioritized as follows:

1.) Automatic Brake Intervention
2.) Reversible Occupant Restraint System Intervention

3.) Electronic Emergency Brake Light

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_166**

If one of the other use cases was already triggered and is still active regarding update, the transmission shall be aborted, if the simultaneously detected use case is of higher priority. Moreover the generation of a new DENM for the use case of higher priority shall be requested.

Details:

Detailed by:

Tested by:

2.1.1.3.2 Use Case Specific Conditions

Requirement   **RS_tcDaSi_167**

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

a. A signal representing the request for the electronic emergency brake light is detected. The conditions for such a request are defined in the European Norm ECE Regulations No. 48, No. 13 and 13-H, see [RD-1].

Due to simplicity the signal mentioned in use case conditions shall be validated by driving parameters. Hence the following condition shall be satisfied beside the condition a):

b. The deceleration of the vehicle shall be smaller than -4 m/s² (validates a hard braking maneuver).

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_168**

The acceleration of the vehicle shall be determined by the CAN bus signal, not by GNSS. The filtered acceleration with respect to sensor noise shall be used.

Details:

Detailed by:

Tested by:

2.1.1.3.3 Information Quality

Requirement   **RS_tcDaSi_169**

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) fulfilled	1

Table 3: Information quality of "Dangerous Situations - Electronic Emergency Brake Light"

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_170**

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:

2.1.1.4 Termination Conditions

Requirement   **RS_tcDaSi_171**

The use case shall be terminated when the condition a) is not any more valid. 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_tcDaSi_172**

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

Details:

Detailed by:

Tested by:

2.1.1.4.2 Negation

Requirement   **RS_tcDaSi_173**

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

Details:

Detailed by:

Tested by:

2.1.1.5 Update

Requirement   **RS_tcDaSi_174**

The generated DENM shall be updated every 100 ms, if the triggering conditions are still satisfied. All data fields that are assigned new values are defined in chapter 2.1.1.8.1. in Table 4.

Details:

Detailed by:

Tested by:

2.1.1.6 Repetition Duration and Repetition Interval

Requirement   **RS_tcDaSi_175**

A repetition of the DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.1.7 Traffic class

Requirement   **RS_tcDaSi_176**

New and update DENMs shall be set to *traffic class* 0.

Details:

Detailed by:

Tested by:

2.1.1.8 Message Parameter

2.1.1.8.1 DENM

Requirement   **RS_tcDaSi_177**

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, because neither negation nor cancellation shall be used in this use case.
eventPosition	*ReferencePosition*. Shall be set according to [AD-3]. Shall be refreshed for every update DENM.
relevanceDistance	lessThan500m(3)
relevanceTrafficDirection	If the roadType is known the value shall be set as follows: <table><tr><td>**RoadType**</td><td>**Direction**</td></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)
validityDuration	2 seconds
stationType	The type of the originating ITS-S. Shall be set according to [AD-3].
Situation Container	

informationQuality	See Chapter 2.1.1.3.3
causeCode	dangerousSituation(99)
subCauseCode	emergencyElectronicBrakeLights(1)

Location Container	
eventSpeed	Speed of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
Traces	*PathHistory* of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
roadType	*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:

Urban / Non-Urban	Structural Separation	Data Element
Urban	No	urban-NoStructuralSeparationToOppositeLanes(0)
Urban	Yes	urban-WithStructuralSeparationToOppositeLanes(1)
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.

Table 4: DENM data elements of "Dangerous Situations - Electronic Emergency Brake Light"

Details:

Detailed by:

Tested by:

2.1.1.8.2 CAM

Requirement   **RS_tcDaSi_178**

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_tcDaSi_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_tcDaSi_180**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to 2, according to [AD-4] (in current specification of [AD-4]: 10). 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_tcDaSi_181**

If the triggering conditions as described in chapter 2.1.1.3 apply, a pseudonym (ID) change shall be blocked for DENMs as long as *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:

2.1.2 Dangerous Situations - Automatic Brake Intervention

2.1.2.1 Description of Use Case

Other (informational)   **RS_tcDaSi_223**

This section describes the triggering of a V2V DENM when a danger of collision is detected and an autonomous emergency braking intervention is carried out. Also in this use case the ego vehicle itself turns into a possible local danger zone.

2.1.2.2 Relations to other Use Cases

Other (informational)   **RS_tcDaSi_224**

The following use cases are related to the *Dangerous Situations - Automatic Brake Intervention* use case, because they share similar triggering conditions:

- Dangerous Situations - Emergency Electronic Brake Light
- Dangerous Situations - Reversible Occupant Restraint System Intervention

2.1.2.3 Triggering Conditions

2.1.2.3.1 Preconditions

Requirement   **RS_tcDaSi_239**

No precondition shall be satisfied for this use case.

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_183**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Electronic Emergency Brake Light* and/or *Reversible Occupant Restraint System Intervention* simultaneously, the use cases shall be prioritized as follows:

1.) Automatic Brake Intervention
2.) Reversible Occupant Restraint System Intervention
3.) Electronic Emergency Brake Light

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_184**

If one of the other use cases was already triggered and is still active regarding update, the transmission shall be aborted, if the simultaneously detected use case is of higher priority. Moreover the generation of a new DENM for the use case of higher priority shall be requested.

Details:

Detailed by:

Tested by:

2.1.2.3.2 Use Case Specific Conditions

Requirement   **RS_tcDaSi_185**

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

a. A signal representing the request for the intervention of an Autonomous Emergency Braking system is detected.

Due to simplicity the signal mentioned in use case conditions shall be validated by driving parameters. Hence the following condition shall be satisfied beside the condition a):

b. The deceleration of the vehicle shall be smaller than -4 m/s² (validates a hard braking maneuver).

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_186**

The acceleration of the vehicle shall be determined by the CAN bus signal, not by GNSS. The filtered acceleration with respect to sensor noise shall be used.

NOTE: Referring to "Euro NCAP Rating Review – Report from the Ratings Group" there are two use cases that have to be covered. A DENM has to be sent if the intervention of an active safety system is detected that fits to Autonomous Emergency Braking system for mid to high speed rear-end longitudinal car collisions (AEB "Interurban), see also "Euro NCAP Rating Review – Report from the Ratings Group". The other use case is related to the detection of intervention of an Autonomous Emergency Braking system for pedestrians which will be scored by Euro NCAP within the area "Pedestrian Protection".

Details:

Detailed by:

Tested by:

2.1.2.3.3 Information Quality

Requirement   **RS_tcDaSi_187**

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) fulfilled	1

Table 5: Information quality of "Dangerous Situations - Automatic Brake Intervention"

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_188**

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:

2.1.2.4 Termination Conditions

Requirement   **RS_tcDaSi_189**

The use case shall be terminated when the condition a) is not any more valid. 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_tcDaSi_190**

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

Details:

Detailed by:

Tested by:

2.1.2.4.2 Negation

Requirement   **RS_tcDaSi_191**

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

Details:

Detailed by:

Tested by:

2.1.2.5 Update

Requirement   **RS_tcDaSi_192**

The generated DENM shall be updated every 100 ms if the triggering conditions are still satisfied. All data fields that are assigned new values are defined in chapter 2.1.2.8.1. in Table 6.

Details:

Detailed by:

Tested by:

2.1.2.6 Repetition Duration and Repetition Interval

Requirement   **RS_tcDaSi_193**

A repetition of the DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.2.7 Traffic class

Requirement   **RS_tcDaSi_194**

New and update DENMs shall be set to *traffic class* 0.

Details:

Detailed by:

Tested by:

2.1.2.8 Message Parameter

2.1.2.8.1 DENM

Requirement   **RS_tcDaSi_195**

Table 6 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, because neither negation nor cancellation shall be used in this use case.
eventPosition	*ReferencePosition*. Shall be set according to [AD-3]. Shall be refreshed for every update DENM.
relevanceDistance	lessThan500m(3)
relevanceTrafficDirection	If the roadType is known the value shall be set as follows: <table><tr><td>**RoadType**</td><td>**Direction**</td></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)
validityDuration	2 seconds
stationType	The type of the originating ITS-S. Shall be set according to [AD-3]
Situation Container	
informationQuality	See Chapter 2.1.2.3.3
causeCode	dangerousSituation(99)
subCauseCode	aebActivated(5)
Location Container	
eventSpeed	Speed of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
traces	*PathHistory* of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.

roadType	*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:		
	Urban / Non-Urban	**Structural Separation**	**Data Element**
	Urban	No	urban-NoStructuralSeparationToOppositeLanes(0)
	Urban	Yes	urban-WithStructuralSeparationToOppositeLanes(1)
	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.		

Table 6: DENM data elements of "Dangerous Situations - Automatic Brake Intervention"

Details:

Detailed by:

Tested by:

2.1.2.8.2 CAM

Requirement   **RS_tcDaSi_196**

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_tcDaSi_197**

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_tcDaSi_198**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to 2, 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_tcDaSi_199**

If the triggering conditions as described in chapter 2.1.2.3 apply, a pseudonym (ID) change shall be blocked for DENMs as long as *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:

2.1.3 Dangerous Situations - Reversible Occupant Restraint System Intervention

2.1.3.1 Description of Use Case

Other (informational)   **RS_tcDaSi_225**

The following use cases are related to the Dangerous Situations - Reversible Occupant Restraint System Intervention use case, because they share similar triggering conditions:

- Dangerous Situations - Electronic Emergency Brake Light
- Dangerous Situations - Automatic Brake Intervention

2.1.3.2 Relations to other Use Cases

2.1.3.3 Triggering Conditions

2.1.3.3.1 Preconditions

Requirement   **RS_tcDaSi_240**

No precondition shall be satisfied for this use case.

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_201**

A parallel activation with the other use cases shall be avoided. In case of triggering the use cases *Electronic Emergency Brake Light* and/or *Automatic Brake Intervention* simultaneously, the use cases shall be prioritized as follows:

1.) Automatic Brake Intervention

2.) Reversible Occupant Restraint System Intervention

3.) Electronic Emergency Brake Light

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_202**

If one of the other use case was already triggered and is still active regarding update, the transmission shall be aborted, if the simultaneously detected use case is of higher priority. Moreover the generation of a new DENM for the use case of higher priority shall be requested.

Details:

Detailed by:

Tested by:

2.1.3.3.2 Use Case Specific Conditions

Requirement   **RS_tcDaSi_203**

Once the following condition is satisfied, the generation of a DENM shall be triggered.

   a. A signal representing the request for the active intervention of a reversible occupant restraint system (e.g. reversible belt tightener) is detected due to a critical driving situation.

Details:

Detailed by:

Tested by:

2.1.3.3.3 Information Quality

Requirement   **RS_tcDaSi_204**

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) fulfilled	1

Table 7: Information quality of "Dangerous Situations - Occupant Restraint System Intervention"

Details:

Detailed by:

Tested by:

Requirement   **RS_tcDaSi_205**

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_tcDaSi_206**

The use case shall be terminated when the condition a) is not any more valid. 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_tcDaSi_207**

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

Details:

Detailed by:

Tested by:

2.1.3.4.2 Negation

Requirement   **RS_tcDaSi_208**

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

Details:

Detailed by:

Tested by:

2.1.3.5 Update

Requirement   **RS_tcDaSi_209**

The generated DENM shall be updated every 100 ms, if the triggering conditions are still satisfied. All data fields that are assigned new values are defined in chapter 2.1.3.8.1. in Table 8.

Details:

Detailed by:

Tested by:

2.1.3.6 Repetition Duration and Repetition Interval

Requirement   **RS_tcDaSi_210**

A repetition of the DENM shall not be used for this use case.

Details:

Detailed by:

Tested by:

2.1.3.7 Traffic class

Requirement   **RS_tcDaSi_211**

New and update DENMs shall be set to *traffic class* 0.

Details:

Detailed by:

Tested by:

2.1.3.8 Message Parameter

2.1.3.8.1 DENM

Requirement   **RS_tcDaSi_212**

Table 8 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, because neither negation nor cancellation shall be used in this use case.
eventPosition	*ReferencePosition*. Shall be set according to [AD-3]. Shall be refreshed for every update DENM.
relevanceDistance	lessThan500m(3)
relevanceTrafficDirection	If the roadType is known the value shall be set as follows: 	RoadType	Direction
0	allTrafficDirections(0)
1	upstreamTraffic(1)
2	allTrafficDirections(0)
3	upstreamTraffic(1) | Otherwise, the value shall be set to allTrafficDirections(0)
validityDuration	2 seconds
stationType	The type of the originating ITS-S. Shall be set according to [AD-3].
Situation Container	
informationQuality	See Chapter 2.1.3.3.3
causeCode	dangerousSituation(99)
subCauseCode	preCrashSystemActivated(2)
Location Container	
eventSpeed	Speed of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
traces	*PathHistory* of the originating ITS-S. Shall be set according to [AD-3]. Shall be refreshed for an update DENM.
roadType	*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: | Urban / Non-Urban	Structural Separation	Data Element
---	---	---
Urban	No	urban-NoStructuralSeparationToOppositeLanes(0)
Urban	Yes	urban-WithStructuralSeparationToOppositeLanes(1)
Urban	unknown	urban-NoStructuralSeparationToOppositeLanes(0)
Non-Urban	No	nonUrban-NoStructuralSeparationToOppositeLanes(2)

	Non-Urban	Yes	nonUrban-WithStructuralSeparation ToOppositeLanes(3)
	Non-Urban	Unknown	nonUrban-NoStructuralSeparation ToOppositeLanes(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.		

Table 8: DENM data elements of "Dangerous Situations - Occupant Restraint System Intervention"

Details:

Detailed by:

Tested by:

2.1.3.8.2 CAM

Requirement   **RS_tcDaSi_213**

CAM adaptation is not required for this use case.

Details:

Detailed by:

Tested by:

2.1.3.9 Networking and Transport Layer

Requirement   **RS_tcDaSi_214**

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_tcDaSi_226**

The interface parameter *hopLimit* between the DEN basic service and the GeoNetworking/BTP shall be set to 2, 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_tcDaSi_227**

If the triggering conditions as described in chapter 2.1.3.3 apply, a pseudonym (ID) change shall be blocked for DENMs as long as *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:

3 Appendix

3.1 Scenarios

Other (informational)   **RS_tcDaSi_228**

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

Other (informational)   **RS_tcDaSi_229**

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

Count	Description	Status
SC_0	Urban environment.	Irrelevant
SC_1	The ego vehicle is in a breakdown state.	Irrelevant
SC_2	The ego vehicle is in a crash state.	Irrelevant.
SC_3	Current road situation and conditions	Not directly relevant
SC_4	Traffic in the opposite driving direction.	Irrelevant
SC_5	The Ego vehicle performs a braking maneuver, such that the "electronic emergency brake light" is triggered. The reason is irrelevant and must not be detected.	Relevant
SC_6	An "autonomous emergency brake function" was triggered. The reason is irrelevant and must not be detected.	Relevant
SC_7	A "reversible occupant restraint system" was triggered. The reason is irrelevant and must not be detected.	Relevant

Table 9: Scenarios for "Dangerous Situations"

3.2 Open Issues

Other (informational)   **RS_tcDaSi_230**

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

Other (informational)   **RS_tcDaSi_235**

The following list encompasses open issues, which are not comprehensively discussed:

Evaluation of only one signal (0 or 1) is assessed as critical due to simple manipulation. Hence, a validation by driving parameters reflecting the scenario must be required. This concerns to all described use cases

In case of PreCrash we recommended, to reject the validation of the signal by another one since often they are redundant. Furthermore, a unique validation by driving dynamics is rather difficult and might differ for different OEMs

Triggering of the underlying active safety function is probably different, since regularities are not strict enough

Defined use case must remain unique, since the used subCauseCodes are directly related to the used active safety functions

Beside the evaluation of the responsible active safety functions, one could define similar triggering conditions based on vehicle dynamics (Ford/Opel) --> new causeCodes or subCauseCodes necessary

- Introduction of more quality levels representing the severity of the situation
- How to manage "false negatives"? Is it possible to decide better than the function itself
- Regarding Chapter Geonet Layer: singlehop? Hoplimit = x?

3.3 Feature Requests

Other (informational)   **RS_tcDaSi_232**

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

3.4 List of abbrevations

Other (informational)   **RS_tcDaSi_233**

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
TTC	Time To Collision
V2V	Vehicle to Vehicle
TC	Triggering Condition

Table 10: Abbreviations

3.5 Applicable documents

Other (informational)   **RS_tcDaSi_234**

[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 11: Applicable documents

3.6 Related documents

Other (informational)   **RS_tcDaSi_241**

[RD-1]   European Norm ECE Regulations No. 48, No. 13 and 13-H

Table 12: Related documents