



Projet  
**SCOOP**  
véhicules et routes connectés  
connected vehicles and roads



French C-ITS Deployment Coordination committee

# Common technical specifications for use cases

## Vulnerable user at a public transport stop

2.4.1.1\_M\_I5

**Activity 2: Studies**

Sub Activity 2.4 > Specifications

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## Information on the document

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Responsible, Entity: Aymeric AUDIGE, ministry of Ecology and Inclusive Transition – DIR Atlantique

## Publishing history

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Black highlighted text are problem with standards.

The following legend is used on the document tables :

Standard / Field: if status is mandatory in standard: **bold**, If optional: *italic*.

Profile / Status:

- If mandatory: **v**
- If optional in standard:
  - Used (**U**) when always used.
  - Not used (**X**) when never used.
  - Sometimes (**S**) when it depends.

Profile / Content: important settings or information are in ***bold italic pink underline***.

# Quality rules

## Reference to the version administration

Version number to be composed of 3 digits > vR.XY

- **R** corresponds to the release number: it is upgraded each time SC Studies validates the diffusion of a new release,

- **X** is the major version number: it is upgraded each time SC Studies validates the deliverable,

- **Y** is the minor version number: it is upgraded each time a contributor changes anything.

Once the deliverable is approved, its version number is upgraded from vR.XY to vR.(X+1)0

Once the deliverable is release, its version number is upgraded from vR.XY to v(R+1).00

As illustration:

0.03 > Work in progress version

0.10 > Del. Approved by SC Studies but not released

2.00 > Del. approved & released (in release 2)

2.05 > Del. Updated - in progress version

## Requirements identification & traceability

In this document, the following verbal forms are used to indicate requirements: **Shall / Shall not**

Recommendations shall be indicated by the verbal forms: **Should / Should not**

Permissions shall be indicated by the verbal forms: **May / May not**

Possibility and capability shall be indicated by the verbal forms: **Can / Cannot**

Inevitability used to describe behaviour of systems beyond of the scope of this del. shall be indicated by: **Will / Will not**

Facts shall be indicated by the verbal forms: **Is / Is not**

In the table here below:

2.4.X.XX > is the number given to the deliverable (e.g. 2.4.4.8)

YYYY > for digit are given to identifying which component/entity the requirement is addressing (e.g. LTCA for long term certificate authority)

ZZZ > is the numeration of the requirement

ID	2.4.X.XX-YYYY-ZZZ
Component(s)	(e.g) ITSS-VU, ITSS-VRO, ITSS-R, PKI
Requirement	(e.g) An ITS station <b>SHALL</b> be able to request and get a Long term Certificate (LTC) from the SCOOP Public Key Infrastructure (PKI).
Acceptance	(e.g) CA1 : ITSS-VU sends a LTC request to the LTCA CA2 : ITSS-R relays the LTC request CA3 : The LTCA verifies the request and sends a response CA4 : The ITSS-R relays the response CA5 : The response is received by the ITSS-VU and is valid
Additional information	

## Acronyms & abbreviations

<b>C-ITS</b>	Cooperative Intelligent Transport Systems
<b>ITS</b>	Intelligent Transport Systems
<b>PT-ITS-S</b>	Public Transport ITS Station
<b>UC</b>	Use Case
<b>V-ITS-S</b>	Vehicular ITS Station
<b>CAM</b>	Cooperative Awareness Message
<b>CPM</b>	Collective Perception Message

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# 1. Introduction and Figure

In this use case, a public transport vehicle is initially stopped at a bus stop. When people are going out from such vehicle, they may cross the street, risking to be hit by an approaching vehicle. To prevent such situation, the stopped public transport vehicle informs other vehicles of its status and alerts the presence of vulnerable users and possibly of their location.

Public transport vehicles can be of different types such as bus, automated shuttle, shared taxi, tramway.

The following situations for the use case specification are introduced :

- Public transport vehicles are vehicles such as bus and tramways that are usually operated on regular journeys and passengers usually exit the vehicle in protected areas, e.g sidewalk, a dedicated platform in a bus lane
- In degraded situations, e.g. a bus has broken down, the public transport vehicle may be stopped on a driving lane and passengers may exit by walking on the road.<sup>1</sup>

Then, multiple scenarios can be identified. Two situations are illustrated in the rest of this section. Note that vulnerable users can be located anywhere around the public transportation vehicle.

In order to clarify the data elements description given for the Vulnerable user at a public transport stop use case, see figure below :

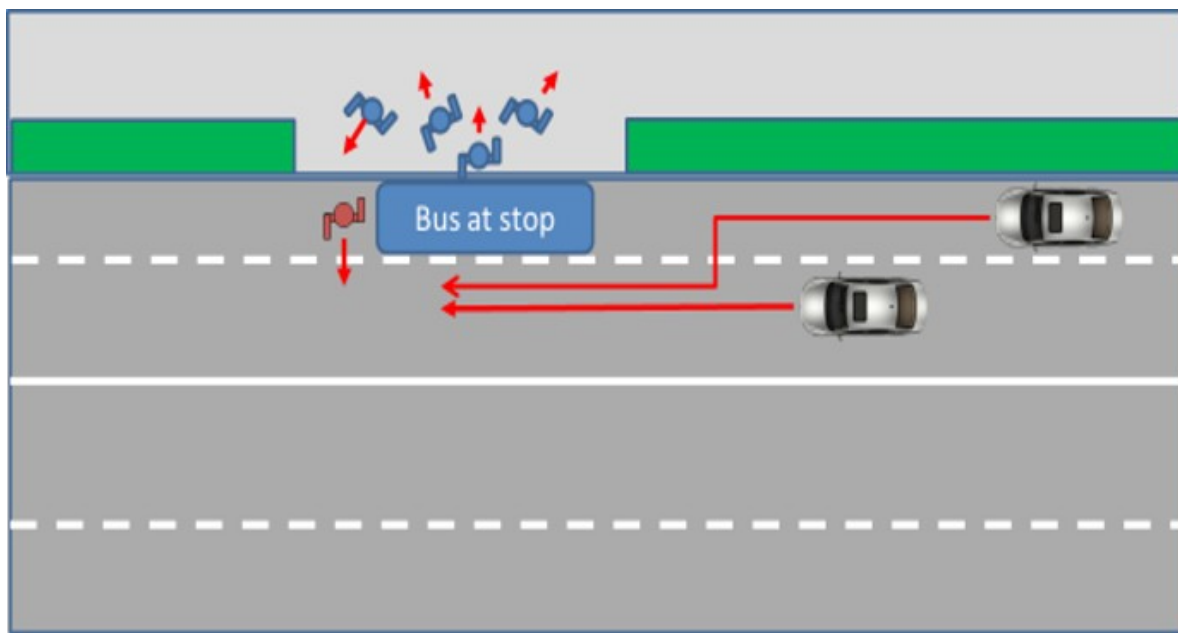


Figure 1: Vulnerable user at bus stop illustration with vehicle driving on same lane

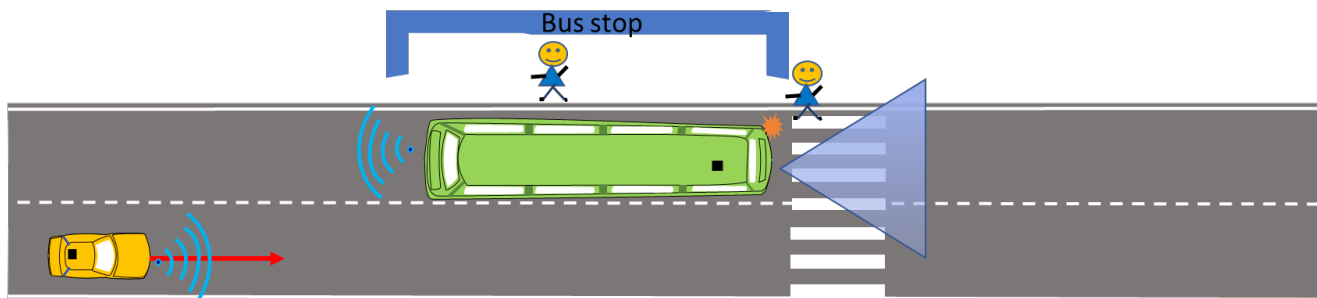


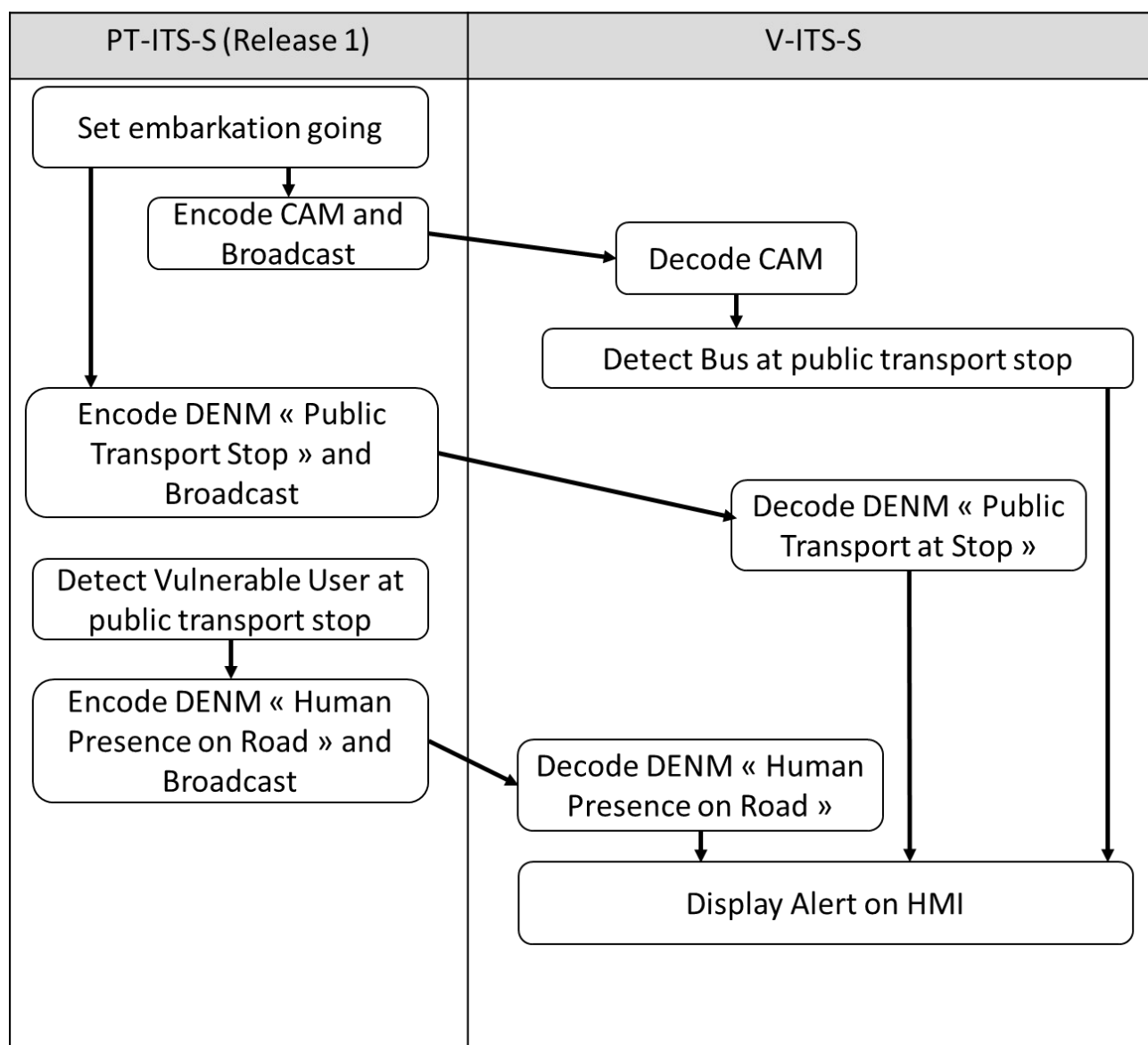
Figure 2: Vulnerable user at bus stop illustration with vehicle driving on opposite lane

<sup>1</sup> Note that in situation, public transport vehicle has broken down, an alert shall be triggered as specified in use case D4 – Alert stationary vehicle / breakdown (I2V).

## 2. Release 1 (without CPM)

### 2.1. Step by step Diagram (Release 1)

This section focuses on the technical specification of the use case for Public Transport ITS Station (PT-ITS-S) equipped with Release 1 facilities (CAM and DENM, no CPM).



### Set embarkation ongoing (PT-ITS-S) :

ID	2.4.1.1_M_I5-PublicTransport-ActivationPTS
Component(s)	V <sub>PT</sub> -ITS-S
Requirement	The device of the V <sub>PT</sub> <b>CAN</b> rely on its “in service” status, its doors status and optionally its blinkers status to activate or deactivate the UC for the PT stop part. It implies connections to these equipment.
Acceptance	CA1 : can depends on the developments asked by the partner .
Additional information	<p>When a public transport vehicle approaches a station, the vehicle informs the other road users by turning on the right-side blinker. Upon doors opening, embarkation starts and is considered ongoing.</p> <p>To trigger the status “embarkation ongoing”, the system can use the following information :</p> <ul style="list-style-type: none"> <li>Public transport vehicle is in service and at least one door is opened by the bus driver.</li> <li>If available, side blinker (right) status can be used to complement assessment.</li> </ul> <p>When embarkation is finished and public transport vehicle is about to leave its station, doors are closed, and the vehicle informs the other road users by turning on the left-side blinker.</p> <p>To turn off the status “embarkation ongoing”, the system can use the following information:</p> <ul style="list-style-type: none"> <li>Public transport vehicle is in service and all doors are closed by the bus driver, i.e. the vehicle is about to leave its station (embarkation is terminated ).</li> <li>If available, side blinker (left) status can be used to complement assessment.</li> </ul>

**Encode CAM and Broadcast (PT-ITS-S) :** CAM is encoded and broadcaster by PT-ITS-S. It shall comply with CAM dissemination specifications of the master document “2.4.1.1\_M\_Master\_V2X: Master technical specifications for V2X use cases”.

Here, the principal parameters set in CAM by PT-ITS-S:

- StationID of PT-ITS-S to track any change in its situation
- ReferencePosition that indicate where the public transport vehicle is stopped
- EmbarkationStatus that indicate whether embarkation process in ongoing or not
- When available, public Transport vehicle heading, width and length
- When available, lane position that indicate the transverse position on which the public transport vehicle is stopped. For instance, if the vehicle has broken down on the road, it can help to detect a danger as persons may exit the vehicle by walking in the driving lane.

Complete CAM communication profile is detailed in the next section.

See CAM profile for further details.

**Decode CAM (V-ITS-S) :** CAM is decoded at message reception in the facilities layer of V-ITS-S

**Detect Bus at public transport stop (V-ITS-S) :** When embarkationStatus in public transport container is set to True, a bus is detected with embarkation process ongoing and pedestrians may be walking in the vicinity of the bus.

**Encode DENM “Public transport at stop” and Broadcast (PT-ITS-S) :** DENM is encoded and broadcaster by PT-ITS-S. It shall comply with DENM dissemination specifications of the master document “2.4.1.1\_M\_Master\_V2X: Master technical specifications for V2X use cases”. See also DENM profile for Public Transport Stop for further details.

**Decode DENM “Public Transport at Stop” (V-ITS-S):** DENM is decoded at message reception in the facilities layer of V-ITS-S.



#### Detect Vulnerable user at public transport stop (PT-ITS-S):

ID	2.4.1.1_M_I5-PublicTransport-ActivationPed
Component(s)	V <sub>PT</sub> -ITS-S
Requirement	The device of the V <sub>PT</sub> <b>CAN</b> rely on its sensors (e.g. a short-range radar or an ultra-sonic sensor belt, camera, etc), that can detect the presence of an obstacle at a short distance to trigger the Pedestrian Presence part. It implies connections to these equipment.
Acceptance	CA1 : can depends on the developments asked by the partner .
Additional information	

**Encode DENM “Human presence on road” and Broadcast (PT-ITS-S) :** DENM is encoded and broadcaster by PT-ITS-S. It shall comply with DENM dissemination specifications of the master document “2.4.1.1\_M\_Master\_V2X: Master technical specifications for V2X use cases”. See also DENM profile for Pedestrian for further details.

**Decode DENM “Human presence on road” (V-ITS-S):** DENM is decoded at message reception in the facilities layer of V-ITS-S

**Display alert on HMI (V-ITS-S):** At the end of this process, relevant information is provided to the driver

- First, a notification is sent indicating the presence of a parked bus at the station at the reception of a CAM or a DENM indication a Public Transport Stop;
- Second, when an alert is received by DENM indicating Human Presence on Road, a pedestrian may be crossing the street and a warning can be displayed to the driver

ID	2.4.1.1_M_I5-PublicTransport-Display
Component(s)	V-ITS-S
Requirement	If relevant, the HMI of the V-ITS-S receiver <b>SHALL</b> display the presence of pedestrian at reception of the dedicated DENM (Pedestrian Presence). It <b>SHOULD</b> display the PT STOP at reception of the dedicated DENM (PT STOP) or the CAM.
Acceptance	
Additional information	The present UC targets the risk with pedestrians, not the fact that the PT Stops.

## 2.2. Information profile – Message description (in details)(Release 1)

ID	2.4.1.1_M_I5-PublicTransport-CAMProfile
Component(s)	V <sub>PT</sub> -ITS-S (for emission), V-ITS-S (for reception)
Requirement	The CAM transmitted by the V <sub>PT</sub> <b>SHALL</b> respect what's expected in the following table (CAM profile for I5).
Acceptance	Referring to the “Status for the UC” column in the table : CA1 : All mandatory <span style="color: green;">█</span> DE and used <span style="color: green;">█</span> DE shall be present in the message emitted, with the defined values. CA2 : All optional <span style="color: yellow;">█</span> DE can be present in the message emitted. See expected values in the table when defined. CA3 : All not used <span style="color: red;">█</span> DE shall be absent in the message emitted,
Additional information	At reception, V-ITS-S receiving a message with not used <span style="color: red;">█</span> DE shall not discard the message. The detection of the PT stop by receiver can rely on this CAM and shall rely on the DENM of PT Stop (because there is no hop with CAM nor in G5 neither in cellular).

## CAM profile for I5 :

CAM ETSI Norm status		Profile		
Field	Status (ETSI)	Status For the UC	Comments	Value set
<b>Header</b>				
protocolVersion	v	v		
messageID	v	v		(is 2)
stationID	v	v		
<b>CoopAwareness</b>				
generationDeltaTime	v	v		
<b>&gt;BasicContainer</b>				
StationType	v	v	Public transport vehicle station type, e.g. bus, tramway...	
ReferencePosition	v	v		
>latitude	v	v	latitude of vehicle position	
>longitude	v	v	longitude of vehicle position	
>confidencePositionEllipse	v	v	See Master_V2X	
>altitude	v	v	See Master_V2X	
<b>&gt;HighFrequencyContainer &gt; CHOICE -&gt; basicVehicleContainerHighFrequency</b>				
heading	v	v		
speed	v	v		
driveDirection	v	x	Not used.	
vehicleLength	v	v		
vehicleWidth	v	v		
longitudinalAcceleration	v	v	Not useful for the use-case..	
curvature	v	v	Not useful for the use-case..	
curvatureCalculationMode	v	v	Not useful for the use-case..	
yawRate	v	v	Not useful for the use-case..	
accelerationControl	S	x		
lanePosition	S	S	When available, lane position where vehicle is stopped.	
steeringWheelAngle	S	x		
lateralAcceleration	S	x		
verticalAcceleration	S	x		
performanceClass	S	x		
cenDsrcTollingZone	S	x		
>LowFrequencyContainer> basicVehicleContainerLow Frequency	S	S	All CAM does not contain this data field. Following DE are mandatory when the container is present in the message.	
vehicleRole	v	v	SHALL be public transport when PT-ITS-S is in service, shall be default otherwise	PublicTransport(1)
exteriorLights	v	v	Not useful for the use-case..	
pathHistory	v	v	Not useful for the use-case..	
>SpecialVehicleContainer	S	U	publicTransportContainer is used	
>>publicTransportContainer	S	v	SHALL be present when vehicle role is set to PublicTransport	
> EmbarkationStatus		v	BOOLEAN / SHALL be True when embarkation process is ongoing and false otherwise. Value of embarkation status is set based on the vehicle doors status. It shall be True when at least one door is open.	
> PtActivation		x	Not used	
>>specialTransportContainer	S	x	Not used	
>>dangerousGoodsContainer	S	x	Not used	
>>dangerousGoodsBasic	S	x	Not used	
>>roadWorksContainerBasic	S	x	Not used	
>>rescueContainer	S	x	Not used	
>>emergencyContainer	S	x	Not used	
>>safetyCarContainer	S	x	Not used	

**Note:** For future release, additional information may be useful to address vulnerable user at public transport stop more completely

- Location of doors that are open to detect from which side persons may exit from the vehicles. This information can be particularly important when person walk out from the public transport vehicle in a shared lane, e.g. at a tramway station
- Types of users carried by public transport vehicles, e.g. children, disabled people, all persons...

ID	2.4.1.1_M_I5-PublicTransport-DENM_PTS_Profile
Component(s)	V <sub>PT</sub> -ITS-S (for emission), V-ITS-S (for reception)
Requirement	The DENM for PT Stop transmitted by the V <sub>PT</sub> <b>SHALL</b> respect what's expected in the following table (DENM profile for PT Stop in I5).
Acceptance	Referring to the "Status for the UC" column in the table : CA1 : All mandatory <span style="color: green;">v</span> DE and used <span style="color: green;">u</span> DE shall be present in the message emitted, with the defined values. CA2 : All optional <span style="color: yellow;">s</span> DE can be present in the message emitted. See expected values in the table when defined. CA3 : All not used <span style="color: red;">x</span> DE shall be absent in the message emitted,
Additional information	At reception, V-ITS-S receiving a message with not used <span style="color: red;">x</span> DE shall not discard the message. The detection of the PT stop by receiver shall rely on this DENM of PT Stop. It can also rely on the CAM (DENM first, because there is no hop with CAM nor in G5 neither relayed in cellular).

DENM profile for Public Transport Stop in I5 :

DENM from vehicle status		Profile		
Field	Status	Status For the UC	Comments	Value
<b>Header</b>				
protocolVersion	<span style="color: green;">v</span>	<span style="color: green;">v</span>		
messageID	<span style="color: green;">v</span>	<span style="color: green;">v</span>		(is 1)
stationID	<span style="color: green;">v</span>	<span style="color: green;">v</span>		
<b>Management container</b>				
actionID	<span style="color: green;">v</span>	<span style="color: green;">v</span>		
detectionTime	<span style="color: green;">v</span>	<span style="color: green;">v</span>		
referenceTime	<span style="color: green;">v</span>	<span style="color: green;">v</span>		
termination	<span style="color: yellow;">s</span>	<span style="color: yellow;">s</span>		
eventPosition	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See the 4 next lines	
>latitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>Latitude of public transport vehicle</b>	
>longitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>Longitude of public transport vehicle</b>	
>confidencePositionElipse	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_V2X / DENM	
>altitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_V2X / DENM	
relevanceDistance	<span style="color: red;">x</span>			
relevanceTrafficDirection	<span style="color: green;">u</span>	<span style="color: green;">u</span>	<b>AllTrafficDirections</b>	Is AlltrafficDirections
validityDuration	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>SHOULD</b> be set according to the duration of embarkation process	
transmissionInterval	<span style="color: red;">x</span>			
stationType	<span style="color: green;">v</span>	<span style="color: green;">v</span>	Type of vehicle (bus, tram, ...)	
<b>Situation container</b>				
informationQuality	<span style="color: green;">v</span>	<span style="color: green;">v</span>		Is 6
eventType	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>CauseCode 94 (Stationnary vehicle)</b> <b>SubcauseCode 4 (Public Transport Stop).</b>	Is 94/4
linkedCause	<span style="color: red;">x</span>			
eventHistory	<span style="color: yellow;">s</span>	<span style="color: red;">x</span>		
<b>Location container</b>				
eventSpeed	<span style="color: yellow;">s</span>	<span style="color: green;">u</span>	Speed value should be standstill(0), because the bus is stopped	
eventPositionHeading	<span style="color: yellow;">s</span>	<span style="color: yellow;">s</span>	May be filled thanks to the pathHistory	
traces	<span style="color: green;">v</span>	<span style="color: green;">v</span>	Filled with the pathHistory of the bus	
roadType	<span style="color: yellow;">s</span>	<span style="color: red;">x</span>		
<b>À la carte container</b>				
lanePosition	<span style="color: yellow;">s</span>	<span style="color: yellow;">s</span>	When available, lane position where vehicle is stopped.	
impactReduction (DF)	<span style="color: yellow;">s</span>	<span style="color: red;">x</span>		
externalTemperature	<span style="color: yellow;">s</span>	<span style="color: red;">x</span>		
roadWorks (DF)	<span style="color: yellow;">s</span>	<span style="color: red;">x</span>		

## 2.4.1.1\_M\_I5 (Vulnerable user at a public transport stop)

DENM from vehicle status		Profile		
Field	Status	Status For the UC	Comments	Value
<i>positioningSolution</i>	<b>S</b>	<b>S</b>	<b>MAY</b> be emitted if the information is known	
<i>stationaryVehicle (DF)</i>	<b>S</b>	<b>X</b>	Not used	

<b>ID</b>	<b>2.4.1.1_M_I5-PublicTransport-DENM_Pedestrian_Profile</b>
<b>Component(s)</b>	V <sub>PT</sub> -ITS-S (for emission), V-ITS-S (for reception)
<b>Requirement</b>	The DENM for Pedestrian Presence transmitted by the V <sub>PT</sub> <b>SHALL</b> respect what's expected in the following table (DENM profile for Pedestrian Presence in I5).
<b>Acceptance</b>	Referring to the "Status for the UC" column in the table : CA1 : All mandatory <b>v</b> DE and used <b>U</b> DE shall be present in the message emitted, with the defined values. CA2 : All optional <b>S</b> DE can be present in the message emitted. See expected values in the table when defined. CA3 : All not used <b>X</b> DE shall be absent in the message emitted,
<b>Additional information</b>	At reception, V-ITS-S receiving a message with not used <b>X</b> DE shall not discard the message. The detection of the PT stop by receiver can rely on this DENM of PT Stop and/or the CAMs of the PT.

## DENM profile for Pedestrian Presence in I5 :

DENM from vehicle status		Profile		
Field	Status	Status For the UC	Comments	Value
<b>Header</b>				
<b>protocolVersion</b>	<b>v</b>	<b>v</b>		
<b>messageID</b>	<b>v</b>	<b>v</b>		(is 1)
<b>stationID</b>	<b>v</b>	<b>v</b>		
<b>Management container</b>				
<b>actionID</b>	<b>v</b>	<b>v</b>		
<b>detectionTime</b>	<b>v</b>	<b>v</b>		
<b>referenceTime</b>	<b>v</b>	<b>v</b>		
<b>termination</b>	<b>S</b>	<b>U</b>		
<b>eventPosition</b>	<b>v</b>	<b>v</b>	See the 4 next lines	
<b>&gt;latitude</b>	<b>v</b>	<b>v</b>	<b>Latitude of public transport vehicle</b>	
<b>&gt;longitude</b>	<b>v</b>	<b>v</b>	<b>Longitude of public transport vehicle</b>	
<b>&gt;confidencePositionElipse</b>	<b>v</b>	<b>v</b>	See Master_V2X / DENM	
<b>&gt;altitude</b>	<b>v</b>	<b>v</b>	See Master_V2X / DENM	
<b>relevanceDistance</b>	<b>X</b>			
<b>relevanceTrafficDirection</b>	<b>U</b>	<b>U</b>	<b>AllTrafficDirections</b>	Is AlltrafficDirections
<b>validityDuration</b>	<b>v</b>	<b>v</b>	<b>SHOULD</b> be set according to the time needed for a pedestrian to cross the street, e.g. 30s	
<b>transmissionInterval</b>	<b>X</b>			
<b>stationType</b>	<b>v</b>	<b>v</b>	Type of vehicle (bus, tram...)	
<b>Situation container</b>				
<b>informationQuality</b>	<b>v</b>	<b>v</b>	Information Quality <b>MAY</b> depend on detection means: <ul style="list-style-type: none"> <li>If sensor detect pedestrians with high quality, information quality should be 6</li> <li>If sensor as low quality to detect pedestrians, is should be 4</li> </ul>	
<b>eventType</b>	<b>v</b>	<b>v</b>	<b>CauseCode 12 (Human Presence on the road)</b> <b>SubcauseCode 0 (Unavailable).</b>	Is 12/0
<b>linkedCause</b>	<b>X</b>			
<b>eventHistory</b>	<b>S</b>	<b>X</b>		

## 2.4.1.1\_M\_I5 (Vulnerable user at a public transport stop)

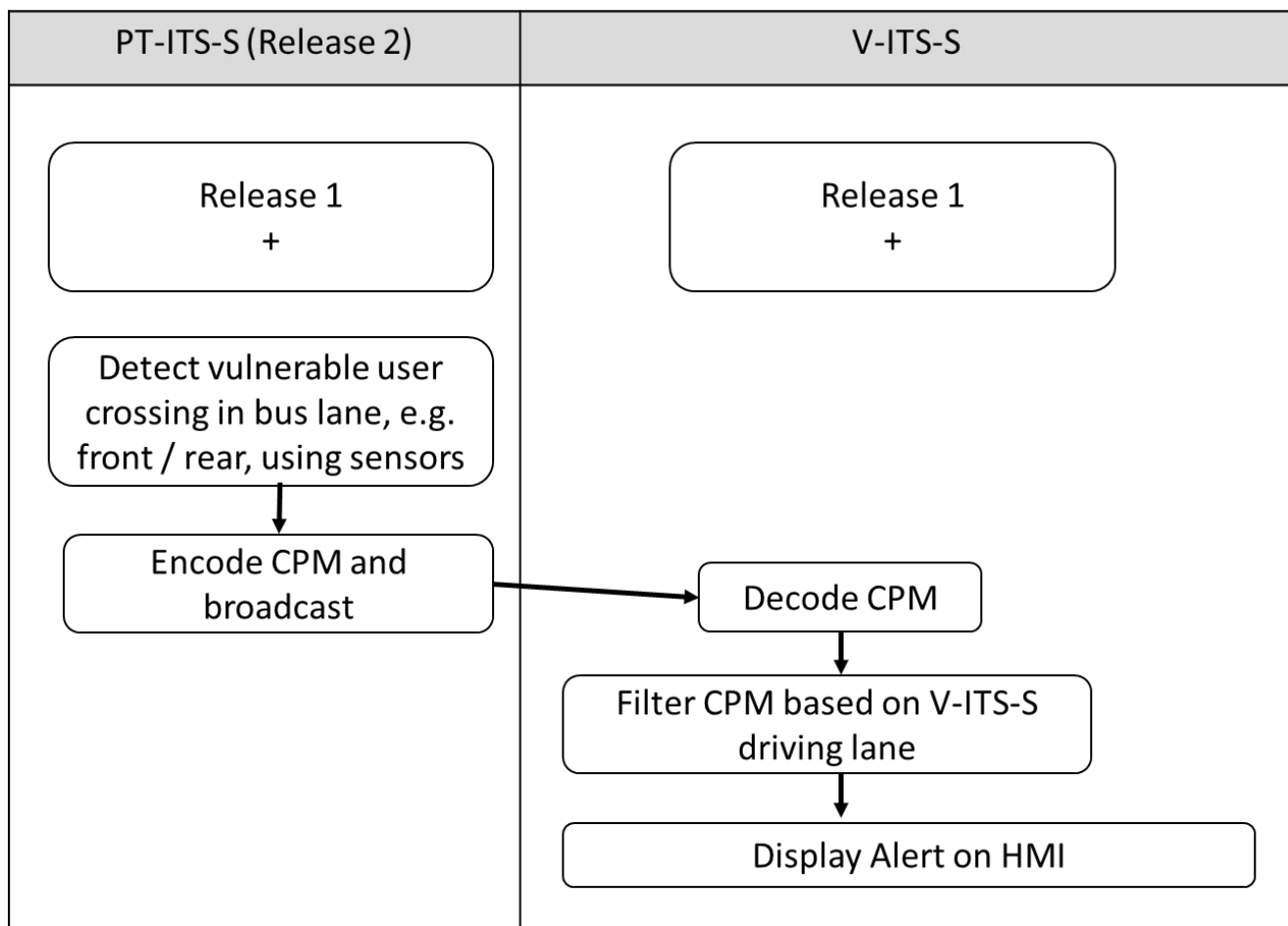
DENM from vehicle status		Profile		
Field	Status	Status For the UC	Comments	Value
<b>Location container</b>				
<i>eventSpeed</i>	S	X	Speed of the pedestrian(s) is unknown	
<i>eventPositionHeading</i>	S	X		
<b>traces</b>	V	V	Filled with the pathHistory of the bus	
<i>roadType</i>	S	X		
<b>À la carte container</b>				
<i>lanePosition</i>	S	X	Not used (can not be filled for the pedestrians by the bus).	
<i>impactReduction (DF)</i>	S	X		
<i>externalTemperature</i>	S	X		
<i>roadWorks (DF)</i>	S	X		
<i>positioningSolution</i>	S	X		
<i>stationaryVehicle (DF)</i>	S	X		

## 3. Release 2 (with CPM)

### 3.1. Step by step diagram (Release 2)

This section focuses on the technical specification of the use case for Public Transport ITS Station (PT-ITS-S) equipped with Release 2 facilities. Such vehicle should also be compliant with specification for PT-ITS-S Release 1 given in above section.

**Disclaimer : before development, the added value of CPM will be considered. Indeed, if release 1 seems sufficient, release 2 could not be developed.**



**Detect vulnerable user crossing in bus lane (V<sub>PT-ITS-S</sub>):** When advanced exteroceptive sensors are available (e.g. camera, radar, lidar,...), road objects located in the vicinity of the bus can be detected and some features (e.g. relative position, type, optionally motion direction and speed,) can be estimated. The presence of pedestrians detected based on these sensors can be transmitted in different situations :

- One or multiple pedestrians are detected in front of the public transport vehicle;
- One or multiple pedestrians are detected at the backside of the public transport vehicle;
- Public transport vehicle is parked on the right side of the road and one or multiple pedestrians are detected at its left side;
- Public transport vehicle is parked on the left side of the road and one or multiple pedestrians are detected at its right side.

For every pedestrian detected in the above-mentioned situations, an information should be transmitted to alert of the user location and the area of detection.

**Broadcast CPM based on intelligent sensors (V<sub>PT</sub>-ITS-S):** CPM is encoded and broadcast by the V<sub>PT</sub>-ITS-S containing the sensor information and perceived objects data selected by “Detect vulnerable user crossing in bus lane” stage. Message generation is managed according to generation rule specified in ETSI TS 103 324 clause 6.1.3.

**Decode CPM (V-ITS-S) :** CPM is decoded at message reception in the facilities layer of the V-ITS-S receiver.

**Filter CPM based on V-ITS-S driving (V-ITS-S) :** Based on received data via CPM, a vehicle (receiver) may filter information about pedestrians location depending of its own driving lane and the location of vulnerable user.

**Display alert on HMI (V-ITS-S receiver) :** At the end of this process, relevant information is provided to the driver:

- When an alert concerning the presence of pedestrian is received via CPM, an alert indicating the location of pedestrian in danger can be displayed to the driver.

## 3.2. Information profile – Message description (in details)(Release 2)

### CPM (ETSI TR 103 562)

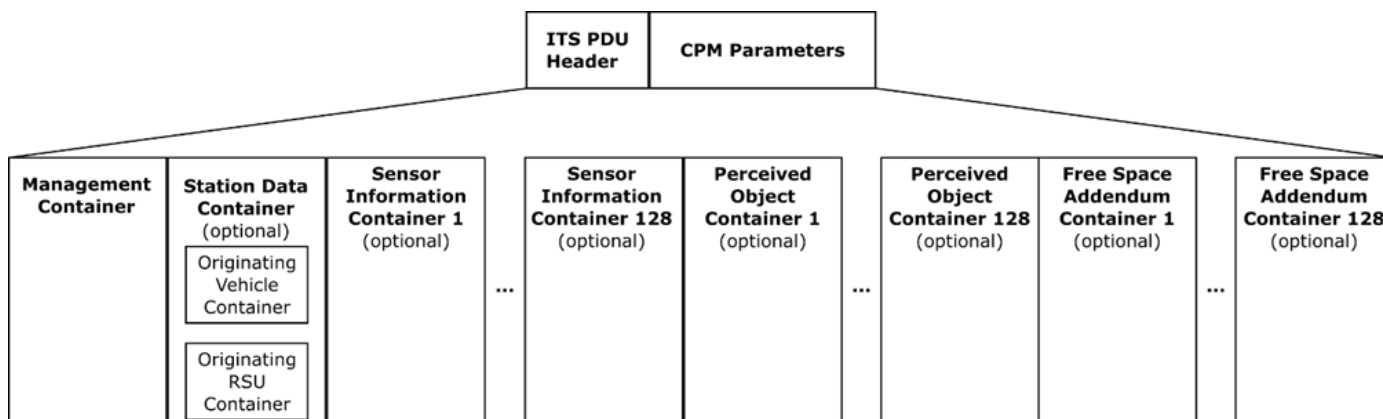


Figure 3: General Structure of a CPM

ID	2.4.1.1_M_I5-PublicTransport-CPMProfile
Component(s)	V <sub>PT</sub> -ITS-S (for emission), V-ITS-S (for reception)
Requirement	The CPM transmitted by the V <sub>PT</sub> <b>SHALL</b> respect what's expected in the following table (CPM profile for I5).
Acceptance	Referring to the “Status for the UC” column in the table : CA1 : All mandatory <span style="color: green;">✓</span> DE and used <span style="color: green;">✓</span> DE shall be present in the message emitted, with the defined values. CA2 : All optional <span style="color: yellow;">⚠</span> DE can be present in the message emitted. See expected values in the table when defined. CA3 : All not used <span style="color: red;">✗</span> DE shall be absent in the message emitted,
Additional information	At reception, V-ITS-S receiving a message with not used <span style="color: red;">✗</span> DE shall not discard the message. The CPM may enhance the service offered by I5 release 5 specification (without CPM).

#### CPM profile for I5 :

CPM		Profile		
Field	Status	Status For the UC	Comments	Value
<b>Header</b>				
protocol Version	<span style="color: green;">✓</span>	<span style="color: green;">✓</span>		
messageID	<span style="color: green;">✓</span>	<span style="color: green;">✓</span>	CPM Message ID is 8 (TR 103 562)	(is 8)
stationID	<span style="color: green;">✓</span>	<span style="color: green;">✓</span>		



## 2.4.1.1\_M\_I5 (Vulnerable user at a public transport stop)

CPM		Profile		
Field	Status	Status For the UC	Comments	Value
cpm			CollectivePerceptionMessage ::= SEQUENCE { generationDeltaTime GenerationDeltaTime, cpmParameters CpmParameters}	
generationDeltaTime	V	V		
>cpmParameters			CpmParameters ::= SEQUENCE { managementContainer CpmManagementContainer, stationDataContainer StationDataContainer OPTIONAL, sensorInformationContainer SensorInformationContainer OPTIONAL, perceivedObjectContainer PerceivedObjectContainer OPTIONAL, freeSpaceAddendumContainer FreeSpaceAddendumContainer OPTIONAL, numberOfPerceivedObjects NumberOfPerceivedObjects,	
>>Management container				
stationType	V	V	<b>Public transport vehicle station type, e.g. vehicle tramway...</b>	
perceivedObjectContainerSegmentInfo	S	S	PerceivedObjectContainerSegmentInfo ::= SEQUENCE { totalMsgSegments SegmentCount, thisSegmentNum SegmentCount}  SegmentCount ::= INTEGER(1..127)	
referencePosition	V	V		
>latitude	V	V	<b>Latitude of public transport vehicle</b>	
>longitude	V	V	<b>Longitude of public transport vehicle</b>	
>confidencePositionElipse	V	V		
>altitude	V	V		
>>stationdataContainer	S	U	<b>-&gt; CHOICE -&gt; originatingVehicleContainer</b>	
heading	V	V	<b>Vehicle heading towards North in degree</b>	
speed	V	V	<b>Vehicle speed value SHOULD be 0 when vehicle is stopped</b>	0
vehicleOrientationAngle	S	S		
driveDirection	S	S		
longitudinalAcceleration	S	S		
lateralAcceleration	S	S		
verticalAcceleration	S	S		
yawRate	S	S		
pitchAngle	S	S		
rollAngle	S	S		
vehicleLength	S	S		
vehicleWidth	S	S		
vehicleHeight	S	S		
trailerDataContainer	S	X	Not used	
>>sensorInformationContainer	S		SensorInformationContainer ::= SEQUENCE SIZE(1..128, ...) OF SensorInformation	
sensorID	V	V		
sensorType	V	V		
detectionArea	V	V	DetectionArea ::= CHOICE { vehicleSensor VehicleSensor, stationarySensorRadial AreaRadial, stationarySensorPolygon AreaPolygon, stationarySensorCircular AreaCircular, stationarySensorEllipse AreaEllipse, stationarySensorRectangle AreaRectangle, ...}  VehicleSensor ::= SEQUENCE { refPointId RefPointId DEFAULT 0, xSensorOffset XSensorOffset, ySensorOffset YSensorOffset, zSensorOffset ZSensorOffset OPTIONAL, vehicleSensorPropertyList VehicleSensorPropertyList, ...}	
freeSpaceConfidence	S	S		



## 2.4.1.1\_M\_I5 (Vulnerable user at a public transport stop)

CPM		Profile		
Field	Status	Status For the UC	Comments	Value
>>perceivedObjectContainer	S	U	PerceivedObjectContainer ::= SEQUENCE SIZE(1..128, ...) OF PerceivedObject	
objectID	V	V	Identifier ::= INTEGER (0..255)  <i>Unique identifier of the detect object</i>	
sensorIDList	S	S		
timeOfMeasurement	V	V	TimeOfMeasurement ::= INTEGER {oneMilliSecond(1)} (-1500..1500)	
objectAge	S	S		
objectConfidence	S	S		
xDistance	V	V	ObjectDistanceWithConfidence ::= SEQUENCE { value DistanceValue, confidence DistanceConfidence}  DistanceValue ::= INTEGER {zeroPointZeroOneMeter(1), oneMeter(100)} (- 132768..132767)  DistanceConfidence ::= INTEGER {zeroPointZeroOneMeter(1), oneMeter(100), outOfRange(101), unavailable(102)} (0..102)  <i>Position of the object along x axis of the sensor</i>	
yDistance	V	V	<i>Position of the object along y axis of the sensor</i>	
zDistance	S	S		
xSpeed	V	V	SpeedExtended ::= SEQUENCE { value SpeedValueExtended, confidence SpeedConfidence}  SpeedValueExtended ::= INTEGER {standstill(0), oneCentimeterPerSec(1),unavailable(16383)} (-16383..16383)	
ySpeed	V	V		
zSpeed	S	S		
xAcceleration	S	S		
yAcceleration	S	S		
zAcceleration	S	S		
yawAngle	S	S		
planarObjectDimension1	S	S		
planarObjectDimension2	S	S		
verticalObjectDimension	S	S		
objectRefPoint	S	S		
dynamicStatus	S	S		
classification	S	U	ObjectClassDescription ::= SEQUENCE (SIZE(1..8)) OF ObjectClass  ObjectClass ::= SEQUENCE { confidence ClassConfidence, class CHOICE { vehicle VehicleSubclass, person PersonSubclass, animal AnimalSubclass, other OtherSubclass}}	
matchedPosition	S	S		
>>freeSpaceAddendumContainer	S		FreeSpaceAddendumContainer ::= SEQUENCE SIZE(1..128, ...) OF FreeSpaceAddendum	
freeSpaceConfidence	V	V		
freeSpaceArea	V	V		
sensorIDList	S	S		
shadowingApplies	V	S		
>>numberOfPerceivedObjects	V	V	NumberOfPerceivedObjects ::= INTEGER (0..255)	