

## French C-ITS Deployment Coordination committee

# Common technical specifications for use cases - embedded VMS

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## Deliverable 2.4.1.2\_H\_C3\_eVMS

### Activity 2: Studies

### Sub Activity 2.4 > Specifications

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## Information on the document

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## Publication history

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Black highlighted texts are issues with standards.

The following legend is used on master document tables (next sub-chapters) and on profiles in each UC documents:

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

Profile / Status:

- If mandatory:
- If optional in standard:
  - Used (U) when always used.
  - Not used ( ) 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.) Vru-ITS-S, Vrq-ITS-S, R-ITS-S, PKI
Requirement	(e.g.) An ITS station SHALL be able to request and get a Long-Term Certificate (LTC) from the SCOOP Public Key Infrastructure (PKI).
Acceptance	(e.g.) CA1: Vru-ITS-S sends a LTC request to the LTCA CA2: R-ITS-S relays the LTC request CA3: The LTCA verifies the request and sends a response CA4: The R-ITS-S relays the response CA5: The response is received by the Vru-ITS-S and is valid
Additional information	

## Acronyms & abbreviations

<b>DENM</b>	Decentralized Environmental Notification Message
<b>eVMS</b>	embedded VMS
<b>HMI</b>	Human-Machine Interface
<b>I2V</b>	Infrastructure To Vehicle
<b>IVI</b>	Infrastructure to Vehicle Information
<b>Nfr-ITS-S</b>	French National ITS Station
<b>N-ITS-S</b>	National ITS Station
<b>OBU</b>	On-Board Unit = V-ITS-S
<b>PF</b>	Platform
<b>R-ITS-S</b>	Roadside ITS Station
<b>RSU</b>	RoadSide Unit = R-ITS-S
<b>TCC</b>	Traffic Control Center
<b>UC</b>	Use Case
<b>V-ITS-S</b>	Vehicular ITS Station
<b>VMS</b>	Variable Message Signal

# Table of Contents

Quality rules .....	3
Acronyms & abbreviations.....	4
Table of Contents.....	5
List of figures.....	6
1. Figure and example of IVI message .....	7
2. Step by step diagram .....	10
3. Information profile – Message description (in details) .....	12

## List of figures

Figure 1 - VMS example illustration with only one “trace” and “eventHistory” .....	7
Figure 2 - eVMS IVI message associated with figure above .....	9
Figure 3 - Classic VMS operations.....	10

## 1. Figure and example of IVI message

In order to clarify the data elements description for the eVMS use case, we start by describing the scenario in the figure below and then the data elements associated in the table.

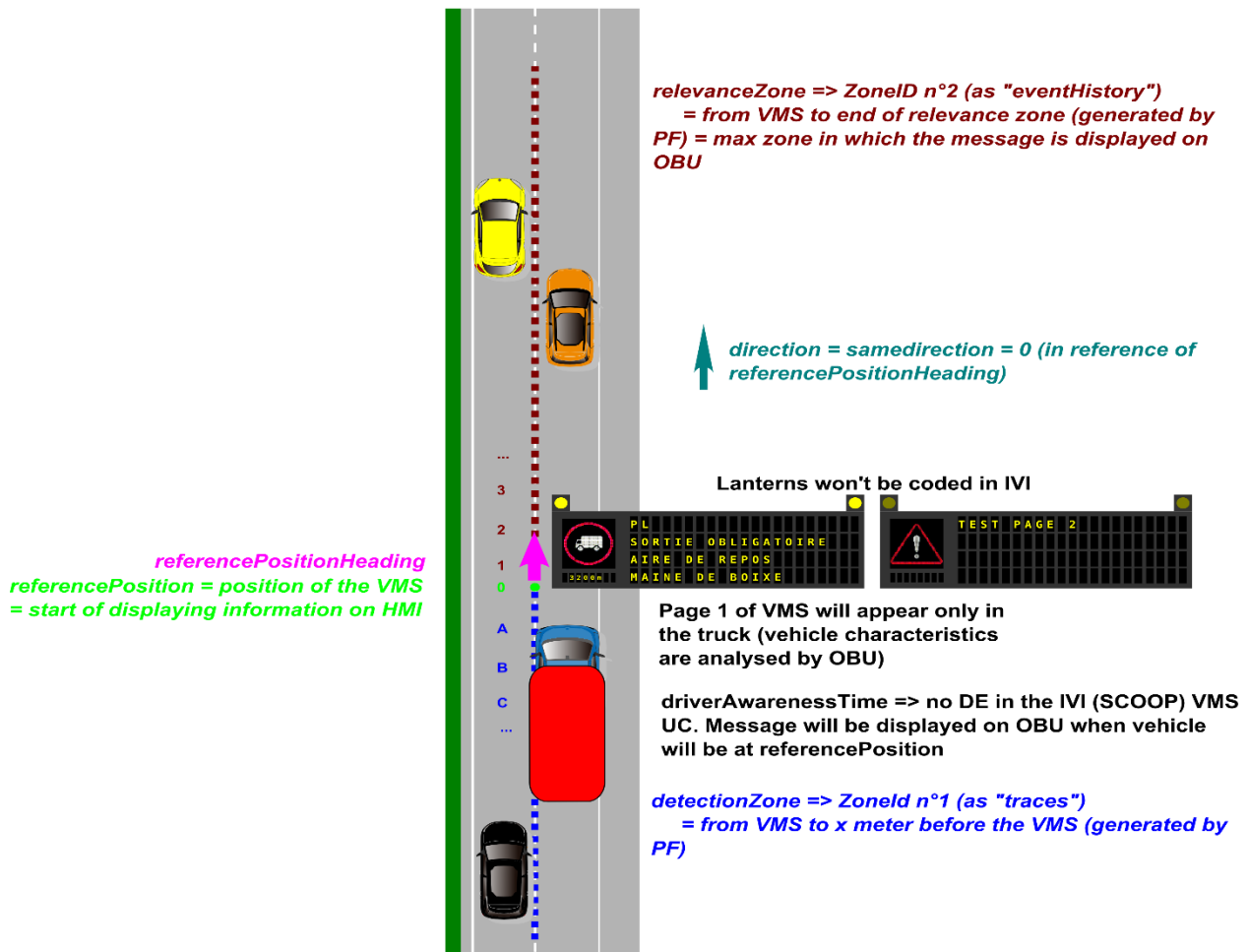


Figure 1 - VMS example illustration with only one "trace" and "eventHistory"

In this figure, VMS can be real or virtual (no difference). There is no two VMS but only a 2 pages VMS (alternate screening).

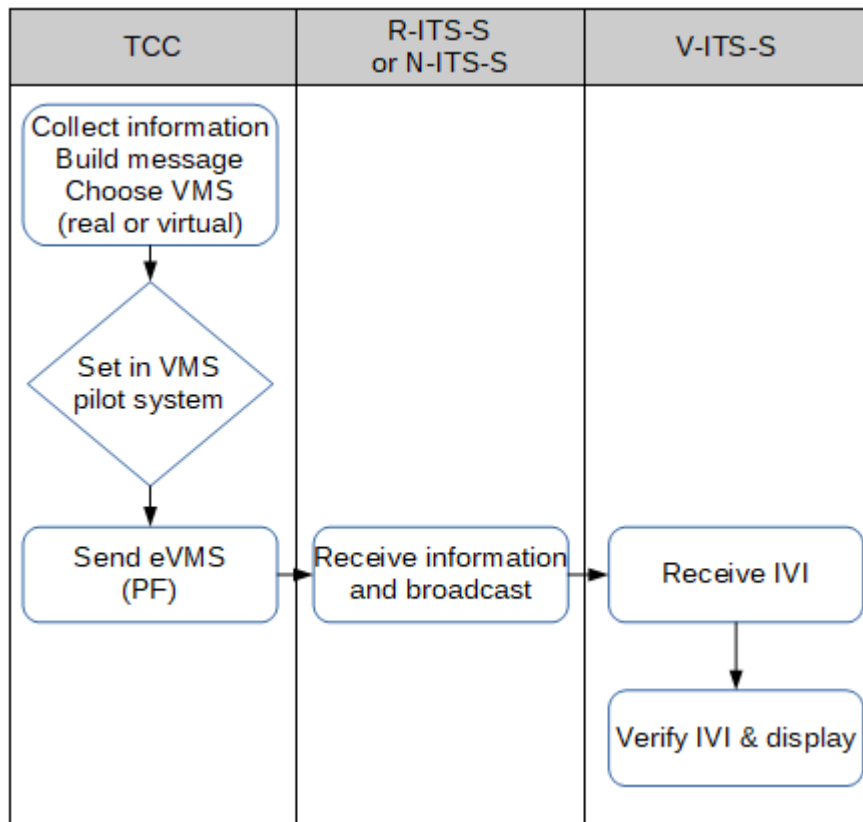
```

#Description of IVI for FR for OnBoard VMS UC (I2V)
#Linked with a figure 2412H-C3-eVMS
#Commented by A. AUDIGE (DIR A)
header {
    protocolVersion currentVersion=1,
    messageID ivi=6,
    stationID 4711
},
ivi {
    mandatory {
        serviceProviderId {
            countryCode 10110 01010, #means 'FR'
            issuerIdentifier 10 033 #DIRA
        },
        iviIdentificationNumber 123456789,
        timeStamp 352425600000,
        validFrom 352447200000,
        validTo 352447200010,
        iviStatus new=0
    },
    optional {
        glc : { #GLC = geographic location container = description of reference point and zones (2 zones in this example)
            referencePosition {
                latitude 481540527, #latitude of point "0" (VMS) =x0
                longitude 164801006, #longitude of point "0" (VMS) =y0
                positionConfidenceEllipse {
                    semiMajorConfidence unavailable=4095,
                    semiMinorConfidence unavailable=4095,
                    semiMajorOrientation unavailable=3601
                },
                altitude {
                    altitudeValue unavailable=800001, #But can be provided if known by the system
                    altitudeConfidence unavailable=15
                }
            },
            parts {
                {
                    zoneId 1, #description of a zone.
                    zoneHeading {
                        headingValue wgs84East(900), #Heading of road at the referencePosition
                        headingConfidence unavailable=127
                    }
                    zone segment : {
                        line deltaPositions : {
                            {
                                deltaLatitude -6637, #exemple = xA-x0
                                deltaLongitude 9289 #exemple = yA-y0
                            },
                            {
                                deltaLatitude -5379, #exemple = xB-xA
                                deltaLongitude 10567 #exemple = yB-yB
                            },
                            ... # number of point needs to be defined.Till 32 points (min 1 point)
                        }
                    }
                },
                {
                    zoneId 2, #description of a zone.
                    zoneHeading {
                        headingValue wgs84East(900), #Heading of road at the referencePosition
                        headingConfidence unavailable=127
                    }
                    zone segment : {
                        line deltaPositions : {
                            {
                                deltaLatitude 7591, #exemple = x1-x0
                                deltaLongitude -7420 #exemple = y1-y0
                            },
                            {
                                deltaLatitude 8278, #exemple = x2-x1
                                deltaLongitude -5379 #exemple = y2-y1
                            },
                            ... # number of point needs to be defined.Till 32 points (min 1 point)
                        }
                    }
                }
            }
        },
        glc : { #GIC = general Ivi container = description of the VMS
            { #First container = page 1 of the VMS (if several page, as in example figure)
                detectionZonelds {1},
                relevanceZonelds {2},
                direction sameDirection=0, #To reference toward zoneHeading
                iviType regulatoryMessages=1,
                vehicleCharacteristics { #Example and optional. If present, must be treated by OBU to check if vehicle is concerned by the
                    train {

```



## 2. Step by step diagram



### Collect information - Build message - Choose VMS (real or virtual):

Generally, traveller information displayed on VMS, installed on the road, may be generated as a result of a planned or unplanned event, which is programmed or scheduled by operations personnel as presented in figure below.

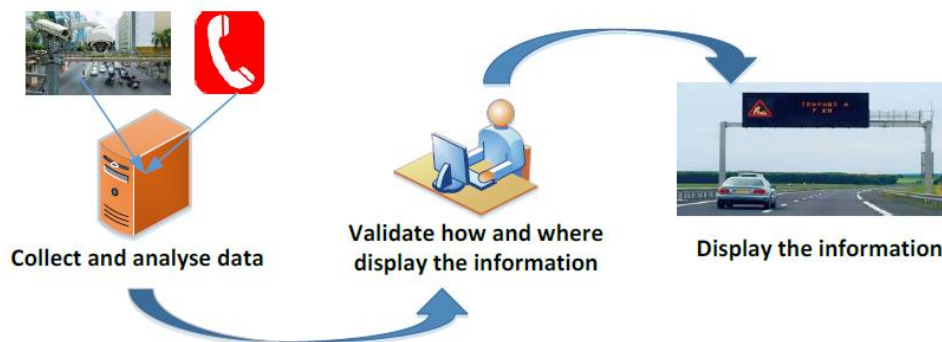


Figure 3 - Classic VMS operations

The present use case allows to display onboard information of real VMS (usual VMS present on field) or virtual VMS (non-existing VMS on field). Due to this new possibility, the road operators should define their policy for virtual VMS localization (with virtual static location) and, if possible, set them in their VMS management tool (with a virtual flag). Road operators can also choose not to use this virtual possibility and thus not integrate any virtual VMS on their frontal.

It is assumed by choice that default relevance zone for a VMS (either real or virtual) is 1 km (see UC technical specification table below). But road operators are authorized to set other length if they want and can do so.

**Set in VMS pilot system:** FR consortium choose that max VMS may contain (as IISR9 application) a text of at most 4 lines of 21 characters each and one pictogram with sub-text 9 characters max, with 2 pages max (alternate screening of two VMS).

Operator has to set VMS (real or virtual) that displays information in VMS pilot system, has to give a start time (if not immediate) and an end time (if known). Operator has also to set a type of message displayed (Datex II type).

**Send eVMS to R-ITS-S or Nfr-ITS-S:** The PF will admit only Datex II format in entrance. Thus, road operators shall have to develop an appropriate interface between their existing tool (VMS pilot system) and the local PF, if needed (e.g. conversion from LCR to Datex II or another format to Datex II). Note that PF shall not send planned message which is not active to R-ITS-S or N-ITS-S.

The PF adapts the Datex II coming from the TMS for the R-ITS-S and Nfr-ITS-S. The data for IVI/detectionZone (similar to DENM/trace) and the data for IVI/relevanceZone(s) (similar to DENM/eventHistory) are calculated as usual, from the relevance zone for the VMS. (see 2.4.3.2\_H and 2.4.1.4\_H)

**Receive information and broadcast (R-ITS-S or N-ITS-S):** The R-ITS-S or Nfr-ITS-S constructs an IVI with the DATEX II data given by the PF.

Canal CCH for 100%-G5 scenario and SCH for hybrid scenario should be used (see 2.4.1\_H for more details). GeoNetwork dissemination and forwarding for 100%-G5 would be the same that for SCooP1 use cases (10km area and ten hops).

**Receive IVI (vehicle):** through architecture. Architecture options are not treated in this document (see 2.4.1\_H). Anyway, whatever route the information has followed, **IVI must have the same serviceProviderId+ivIdentificationNumber and the same timeStamp (as presented below in profile)**. So that vehicle treats one message or the other, but not both of them.
















**Verify IVI and display IVI:** message is displayed on HMI from VMS position or before it (pre-awareness is recommended for this UC). To classify and prioritize the information between several VMS messages, the receiving vehicle may use the data element IviType (see below for further details), that provides the message category.

The process of vehicle receiver can be as followed:

1. The vehicle checks serviceProviderID+ivIdentificationNumber and timestamp to verify if the event is already known, if it is a new event or if it is an update.
2. The vehicle checks validFrom and validTo to determine if the event is active.
3. The vehicle checks referencePosition to determine how far from its position the event is and calculate its time-to-event.
4. The vehicle checks detectionZone. If vehicle is following the linear described by zone(s), it is concerned by event (which is upstream). If not, the vehicle can compare zoneHeading with its own current heading and the way it is approaching the referencePosition by rear to know if it is concerned or not (difference between headings should be more or less about +/- 30°).
5. The vehicle checks presence of extraText container. If true, it's an eVMS.
6. HMI displays the message from referencePosition point (or before) and displays it all along the relevanceZone. However, if vehicleCharacteristics are given by IVI, can be processed by the vehicle and are not checked (involved the receiver know its own characteristics), message is not displayed.
7. If the eVMS message include 2 pages, they can be displayed all together (if enough place in HMI) or through a switching routine or else (car manufacturers domain).

### 3. Information profile – Message description (in details)

IVI transverse state		Profile eVMS		
Field	Status from transverse]	Status For the UC	Comments	Value set
<b>Header</b>				
protocolVersion			See 2.4.1.2_H_Master document / IVI	
messageID			See 2.4.1.2_H_Master document / IVI	(is 6)
stationID			See 2.4.1.2_H_Master document / IVI	
<b>Management container</b>				
serviceProviderId			See 2.4.1.2_H_Master document / IVI	
ivIdentification Number			See 2.4.1.2_H_Master document / IVI	
timestamp			See 2.4.1.2_H_Master document / IVI	
validFrom			See 2.4.1.2_H_Master document / IVI	
validTo			See 2.4.1.2_H_Master document / IVI With a default value of 3600s (1 hour) for this UC.	
connectedIviStructures				
iviStatus			See 2.4.1.2_H_Master document / IVI	
<b>Geographic Location Container</b>				
referencePosition			Position of the VMS on the road, either real or virtual. Transverse position is in the <b>middle of the carriageway</b> .	by PF
referencePosition Time				
referencePosition Heading				
referencePositionSpeed				
parts			See 5 next lines	
>zoneId			First zone(s) Id(s) may be used to define the “detection zone(s)”, approach of the VMS (similar to traces in DENM). Then, next zone(s) Id(s) may be used to define “relevance zone(s)” in which the VMS message is relevant (display zone / similar to eventHistory in DENM). By default, the length of those relevance zone is set to 1 km by FR choice (seems pertinent). If there is another VMS (or eVMS) within this distance, a shortened distance is recommended. Anyway, if road operator wants to set other length, they are authorized to do so. Minimum is 2 zone Id for eVMS (e.g. one trace / detection zone and one eventHistory / relevance zone)	by PF
>laneNumber			eVMS UC will concern all lanes.	
>zoneExtension				
>zoneHeading			<b>Heading direction of the carriageway concerned by the VMS.</b>	by PF
>zone			See 2.4.1.2_H_Master document / IVI	
<b>General IVI Application Container</b>			<b>If the VMS is on one page, only one container will follow. If it is a two pages VMS (alternate screening), two container will be included.</b>	
detectionZoneIds			See 2.4.1.2_H_Master document / IVI	
its-rrid				
revelanceZoneIds			See 2.4.1.2_H_Master document / IVI	
direction			See 2.4.1.2_H_Master document / IVI	
driverAwareness ZoneIds				
minimumAwareness Time				
applicableLanes			eVMS UC will concern all lanes.	

IVI transverse state		Profile eVMS		
Field	Status from transverse]	Status For the UC	Comments	Value set
<b>iviType</b>			Single conversion of VmsMessageInformationTypeEnum of Datex II given by TCC: situation warning => "0" instruction or message => "1" traffic management or travel time => "2" campaign message or future information => "4" date time or temperature => no IVI conversion, not emitted	is 0, 1, 2, 3 or 4
<i>iviPurpose</i>				
<i>laneStatus</i>				
<i>vehicleCharacteristics</i>			<b>To be provided when IVI concerns specific type of vehicles. + See Master</b>	
<i>driverCharacteristics</i>				
<i>layoutId</i>				
<i>preStoredLayoutId</i>				
<b>roadSignCodes</b>			See 2.4.1.2_H_Master document / IVI	
<i>extraText</i>			Most of the time provided, except if only a road sign with no text (should not happen in real life). <b>Coding of sub-road sign panel is coded between "/"</b> <b>(example: //25km//) in the first container of extraText</b> If well interpreted, it will be displays properly on HMI. If not, users may understand it well enough. So that it is a solution respecting standard constraints without any interoperability issue generated.	
<i>Road Configuration Container</i>				
<i>Text Container</i>				
<i>Layout Container</i>	