EURO NCAP

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Child Presence Detection Evaluation

Safe Driving

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PREFACE

During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer's representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

DISCLAIMER: Euro NCAP has taken all reasonable care to ensure that the information published in this protocol is accurate and reflects the technical decisions taken by the organisation. In the unlikely event that this protocol contains a typographical error or any other inaccuracy, Euro NCAP reserves the right to make corrections and determine the assessment and subsequent result of the affected requirement(s).

CONTENTS

1 INTRODUCTION

The evaluation of direct sensing systems will be based on information provided by the vehicle manufacturer and laboratory checks. A dossier is required detailing how the system establishes the presence of a child and the sequence, including timing, of subsequent warnings and intervention(s). The information required is detailed in the following sections.

Euro NCAP reserves the right to check any and/or all of the CPD requirements during the vehicle assessment. This includes all system functionality such as sensing, warnings, intervention and HMI.

In order for any CPD points to be awarded, the dossier must contain the information detailed in the following sections and system must react correctly to all of the scenarios outlined in this section.

The sensing test tool validation must be approved by Euro NCAP in advance of dossier delivery and vehicle assessment. Where a technology is presented to Euro NCAP that is not adequately evaluated with the test procedure, the OEM must contact the Euro NCAP Secretariat and a way to proceed will be developed.

If the test tool is already approved by Euro NCAP and listed in Technical Bulletin G 003 it will not be necessary to provide further validation of the tool providing the tool is listed in combination with the corresponding sensor technology used in the vehicle under assessment.

1.1 Dossier contents

It is the OEM's responsibility to provide all of the necessary information required to demonstrate the performance of the system in accordance with the Euro NCAP assessments. Information relating to all of the following sections must be provided in advance on CPD assessment.

1.1.1 General system information – required for laboratory checks

- Sensor type and principle: Wi-fi, RF, camera etc.
- Sensor location and CPD system architecture
- Detection: movement, respiration etc.
- Coverage areas, including influence of unoccupied seat range adjustments, footwell and all optional seats, e.g. 3rd row.
- Deactivation: temporary/long term (where applicable).
- CPD mobile device applications necessary for warnings (where applicable).
- Occupant age coverage for children and, where applicable adults

1.1.2 Sensing data

- Respiration monitoring output.
- Movement monitoring output, other as applicable.
- Triggering thresholds and any grey zone information.

- Influence from any external interference e.g. sunlight, electromagnetic or radio waves.
- Sensing data is required to demonstrate detection capabilities and validate functionality in ‘worst case’ conditions, see Section 1.4.

1.1.3 Demonstration of system compliance

- Sensing of scenarios detailed in Section 1.2.
- Sensing and decision time to warning activation detailed in Section 3.1.1 of the Occupant Monitoring protocol.
- Warning and intervention functionality detailed in Section 3.1.3 and 3.1.4 of the Occupant Monitoring protocol.
- CRS to be used as detailed below.
- Warning signal demonstration.
- Intervention demonstration (where applicable, not mandatory)

1.1.4 Validation of test tool (where applicable)

- See Section 1.4 for further information

1.2 Evaluation scenarios

Direct sensing systems must be able to react correctly to all possible use cases. The necessary required child occupant details are below.

The assessments may be performed either in-door (parking garage) or outside. However, elements that are necessary to the function of the system should be present, such as phone signals and temperature where applicable.

1.2.1 Scenarios 1 & 2 (forgotten and intentionally left behind)

New-born infant in a rearward-facing CRS:

- Sleeping without limb movement under blanket/sun shield

One-year old infant/child in a rearward-facing CRS:

- Sleeping under blanket without limb movement
- Awake under blanket with limb movement

Three-years old child in forward-facing CRS:

- Sleeping under blanket without limb movement
- Awake under blanket with limb movement

Six-years old on booster cushion installed with three-point belt

- Sleeping without limb movement

- Awake with limb movement

1.2.2 Blanket and sun-shade

For the sleeping situations the blanket shall be placed over the child from the shoulders down to cover the feet with arms beneath. For the awake situations, the blanket shall be placed over the child from the chest down to cover the feet with the arms above the material.

The blanket to be used shall be no less than 70cm x 90cm, 300GSM in weight and made from Cotton or Polyester.

A sun-shade shall also be used with rearwards facing CRS that attaches from the carry handle to the seat shell around the head. Alternatively, a shade may be improvised from a cotton cloth placed around the shell of the CRS and covering the opening.

1.2.3 CRS to be installed

The following CRS must be used for each of the use cases detailed in Section 2. The CRS will be installed on 'relevant' vehicle positions, for example Universal CRS on all belted seating positions.

- **New-born infant** (4kg) in a Maxi Cosi Cabriofix or Pebble 360. Universal CRS, belted installation rearward facing.
- **New-born infant** (4kg) in a Maxi Cosi Pebble 360 on FamilyFix 360 base, rearward facing. Installation of child only, CRS (base and shell) already installed in vehicle.
- **P3 or Q3** in Britax Roemer King II LS, belted installation, forward facing.
- **Q6** on a Concord Vario XT-5, belted installation, or Joie Signature i-Spin XL forward facing.

1.2.4 Scenario 3 (child enters unlocked vehicle)

The conditions for evaluating Scenario 3 are detailed below.

- Parked vehicle with unlocked doors
- A door (any door) is opened, test subject enters vehicle and door is closed (not locked) but with child lock activated.
- Sensor is triggered (directly, or after a delay time detailed in Section 3.1.2 of the Occupant Monitoring protocol) to check if a living being is in the vehicle (footwell included).
- Where presence is confirmed, the initial warning must be triggered in accordance with Section 3.1.3 of the Occupant Monitoring protocol.

1.3 Specific system requirements

Systems may use a range of parameters either individually or in combination to establish occupancy and/or categorisation. For systems that detect occupant respiration or movement, the individual parameters to be proven by the OEM are as follows:

1.3.1 Respiration

The following respiration rates shall be used for sleeping children:

- New-born infant 30bpm
- One year old 22bpm
- Three year old child 20bpm
- Six year old 18bpm

1.3.2 Movement and motion

Presence of childlike manikin, sizes and cases requiring random movement. The following movement is accepted for children in a CRS:

- Head: Pitch, roll, yaw
- Upper and lower limbs: Waving, kicking, playing on a mobile phone…

1.3.3 Day and night

Systems that rely on optical sensing methods, such as cameras, require demonstrations to show that occupants can be detected in a range of lighting conditions, for example day and night-time.

1.4 Test tool validation

The OEM and/or system supplier is required to provide information detailing the validation of any test tools used. Where tools are used in place of human subjects, validation data is required to demonstrate that the test tool can be used as a suitable human surrogate.

A direct comparison between the output recorded with humans and the test tool(s) is required in a vehicle environment. The test scenarios described above shall be replicated along with details of the ‘worst case’ conditions/subject for the sensing technology.

A range of human subjects is required from new-born to 6YO, along with age, weight and stature must also be provided to demonstrate the worst-case human for the detection system is covered by the test tool. Depending on what parameter is being evaluated, it may be necessary to seat the children, or position the respective test tool(s), in an appropriate CRS.

Where human subjects are used either in the development of test tools or validation of a CPD system, all relevant ethical and privacy guidelines must be followed.

2 LABORATORY TESTS

Vehicle assessments will be carried out by the vehicle inspectors and assessed using a number of ‘use cases’ representing typical conditions. Only systems that trigger a correct response in all defined use cases will be eligible for scoring.

2.1 Scenarios 1 and 2

The use cases, detailed below, represent typical situations that might occur when a child is taken on a journey. These cases ware currently under review and will be updated.

Each use case is detailed with the use of certain subsequent steps (actions) to be carried out in a specific order. The assessment will be carried out by following the individual actions in the order detailed for each use case.

The numerical part of each action details the type of action to be performed, such as opening/closing doors and locking the vehicle. The alphabetic part of each step provides specific details of what action to perform where multiple possibilities exist. The key to each of the individual actions is in Section 2.3.

1) Preparation
2) Simulated entry – adult and/or child
3) Driving
4) Stopping
5) Simulated exit
6) Activation – at end of journey
7) Warning – required or not

Where the system can only detect occupants and not classify, triggering of the system may be done with any human subject.

2.1.1 Use case 1

This simulates two separate journeys, one is starting with a locked and the other an unlocked vehicle. In both cases, the driver forgets to remove the child at the end of the journey and locks the vehicle. A CPD initial warning is required. These are two independent use cases that should be assessed separately.

Actions

Locked	1A→	2B→	3C→	4B→	5A→	6A→	7A→	End
Unlocked	1B→	2B→	3C→	4B→	5A→	6A→	7A→	End

2.1.2 Use case 2

This simulates a journey, starting with a locked vehicle, where a child remains in the vehicle at the end of the journey but only the driver door is opened and closed. No other doors are opened and, where fitted, the CPD initial warning is delayed by the driver for example refuelling. A CPD warning is required within 10 minutes of delay activation.

Actions

1A→ 2B→ 3C→ 4B→ 5A→ 6C→ 7B→ 10mins (max) → 7A End

If a system does not offer the possibility to delay the CPD signal, this assessment can be ignored.

2.1.3 Use case 3

This simulates a journey, starting with a locked vehicle, where a child is installed in the vehicle and only the driver door is opened and closed during a journey. No other doors are opened and, where fitted, the CPD signal is delayed by the driver for refuelling. The driver then continues the journey (within 10 mins) and then forgets to remove the child at the end of the journey (only). A CPD initial warning is required upon door locking at the end of the journey. This is one single use case for one journey.

Actions

1A→ 2B→ 3C→ 4B→ 5A→ 6C→ 7B→ <10min

Journey recommences

1A→ 2A→ 3C→ 4B→ 5A→ 6A→ 7A End

If a system does not offer the possibility to delay the CPD signal, this assessment can be ignored.

2.1.4 Use case 4

This simulates a journey, starting with a locked vehicle, where a child is installed in the vehicle but only the driver door is opened and closed. No other doors are opened and, where fitted, the CPD initial warning is delayed by the driver for refuelling. A warning is expected within 10 minutes of delay activation. The same journey recommences (within 15min of door locking), the driver forgets the child at the end of the journey, no other doors have been opened, a CPD warning is required. This is one single use case in one journey.

Actions

1A→ 2B→ 3C→ 4B→ 5A→ 6C→ 7B→ 10mins→ 7A

Journey recommences

1A→ 2A→ 3C→ 4B→ 5A→ 6A→ 7A End

If a system does not offer the possibility to delay the CPD signal, this assessment can be ignored.

2.1.5 Use case 5

This simulates a journey, starting with a locked vehicle with no rear doors, where the driver forgets to remove the child at the end of the journey and locks the vehicle. A CPD warning is expected if the actions required to access the rear seat and child (e.g. move driver's seat) are not repeated before door locking.

Actions

1A→ 2B*→ 3C→ 4B→ 5A→ 6A→ 7A End

*2B shall include the necessary actions to access the rear seats.

2.1.6 Use case 6

This simulates a journey, starting with a locked vehicle, where there are two children installed in the vehicle. One child exits the vehicle mid-journey and the journey continues. At the end of the journey the driver exits the vehicle and forgets the one remaining child. A CPD warning is required.

Actions

1A→2B→ 3C→ 4C→ 5E→ 5A→ 6A→ 7A End

2.1.7 Use case 7

This simulates a journey, starting with a locked vehicle, where there is no child in the vehicle at the start of the journey. A child then enters the vehicle mid-journey and the journey continues. At the end of the journey the driver exits the vehicle and forgets the child. A CPD warning is required.

Actions

1A→ 2A→ 3C→ 4C→ 2D→ 3E→ 4D→ 5A→ 6A→ 7A End

For vehicles with seven seats and a 3rd row, the child entry mid-journey (2D) shall be through the boot door to access the 3rd row seats where the boot is considered a reasonable means of access.

2.1.8 Use case 8

This simulates a journey, starting with a locked vehicle, where a child is installed in the vehicle. The journey ends and the driver exits the vehicle. The rear door adjacent to the child is opened and closed without the child being removed from the vehicle, which is then locked. This is the intentionally left case and a CPD warning is required. This scenario (2) is currently monitored and the outcome will not be included in the system assessment. However, the datasheet and website publication will detail if this scenario is covered by the system or not.

Actions

1A→ 2B→ 3C→ 4B→ 5B→ 6A→ 7A End

2.1.9 Use case 9

Avoidance of false positives.

Systems will be checked for false positives in the two scenarios detailed below. However, although compliance with the case below is strongly recommended, the outcome will not be included in the system assessment.

This simulates a journey, starting with a locked vehicle, where the driver removes the child at the end of the journey. No children are in the vehicle when locked, in this case a warning is NOT required.

Actions

1A→ 2B→ 3C→ 4B→ 5D→ 6A→ 7B End

2.1.10 Use case 10

Avoidance of false positives.

This simulates a journey, starting with a locked vehicle, where the driver opens the door and places/hangs and object in the rear before the journey. At the end of the journey, the door remains unopened at the time of locking, in this case a warning is NOT required.

Actions

1A→ 2C→ 3C→ 4B→ 5A→ 6A→ 7B End

2.2 Scenario 3

Use cases for Scenario 3 are under development. The actions required to evaluate system functionality in this scenario will be added when they are available.

2.3 Key to Scenario 1 & 2 use cases

			A	B	C	D	E
1	*Prepare*		Unlock car	Start with unlocked car, left for [30] minutes			
2	*Simulate entry*		Open driver's door	Open any door (for at least 7 sec, no more than 12 sec) adjacent to where a child can be placed*	Open any door (for at least 7 sec, no more than 12 sec) adjacent to where a child can be placed*	Open any door (for at least 7 sec, no more than 12 sec) adjacent to where a child can be placed*	Open any door (for at least 7 sec, no more than 12 sec) adjacent to where a child can be placed*
			Close driver's door	Place surrogate/CRS on seat**	Close door	Place surrogate/CRS on seat**	Close door
				Close door	Open driver's door	Close door	
				Open driver's door	Close driver's door		
				Close driver's door			
3	*Journey (in motion)*		No action	Ignition on	Ignition on	Ignition on	Simulate driving
					Simulate driving	Simulate driving	
						Simulate second entry or exit***	
4	*Stopping*		No action	Ignition off	Vehicle stops, ignition on	Vehicle stops, ignition off	
5	*Simulate exit*		Driver door opens	Driver door opens	Door adjacent to seating position where child can be retrieved is opened	Driver door opens	Door adjacent to seating position where child can be retrieved is opened
			Driver door closes	Driver door closes	Simulate further driving/Stopping/Exit	Driver door closes	Retrieve child surrogate
				Door adjacent to seating position where child can be retrieved is opened		Door adjacent to seating position where child can be retrieved is opened	Simulate further driving/Stopping/Exit
				Door closed		Retrieve child surrogate	
						Door closed	
6	*Activation*		Doors locked	No further actions performed.	Doors locked, delay active		
7	*Initial warning*		Warning expected	Warning not expected			
	Key:		Highlighted actions can be performed out of order		*for 3 door car, driver's door included		
					**for 3 door car, perform action to access rear seats		
					***7 seaters, access through boot door		